A Re-Evaluation of the Oxbow Dam Site (DhMn-1): Middle Holocene Cultural Continuity on the Northern Plains

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ABSTRACT

The following thesis includes a re-examination of research conducted at the Oxbow Dam site (DhMn-1) in southeastern Saskatchewan in 1956 as well as the results of new research conducted at the site in 1995 and 1996. The material recovered during the original excavation was instrumental in defining the Oxbow cultural complex of the Northern Plains (Nero and McCorquodale 1958). As research on the subject progressed through the 1960s, 70s, 80s, and 90s, many archaeologists felt that the original assemblage no longer fit directly into the complex but, instead, represented a transitional period from antecedent Mummy Cave series complexes into an early example of the Oxbow complex. This notion was based on the fact that the 1950s excavation produced a radiocarbon date that was much older than those produced from subsequent research. Furthermore, the assemblage, which was thought to represent a single component, contains artifacts that are atypical of the complex as it is currently understood.

The results of the 1995 and 1996 field work indicate that the site is actually multicomponent and that the Oxbow material is a relatively late example of a campsite from the complex. In light of these results, it appears that the original radiocarbon date was likely contaminated and that the artifact assemblage was a mixture of two or more cultural components; a combination which simulated what an early Oxbow component might look like. An overview of assemblages from various sites within the complex, however, strongly suggests that cultural continuity exists between grassland Mummy Cave series variants like Gowen (Walker 1992) and later Oxbow

assemblages while certain aspects of the complex indicate southern and eastern trade influences.

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LIST OF ABBREVIATIONS

Art #	artifact number
BP	Before Present (1950)
BCOI	insoluble bone collagen
BCOS	solubilized bone collagen
cal	calibrated
cf.	compare (L. confronte)
cm	centimeter
f.s.	fused shale
g	grams
indt	indeterminate
KRF	Knife River Flint
m	meter
m m	millimeter
MNI	minimum numbers of individuals
Min.	minimum
Max.	maximum
M 1	first molar
N/A	not applicable
NISP	Number of indentified specimens
No.	number
SBDA	Souris Basin Development Authority
SMNH	Saskatchewan Museum of Natural History
sp.	species
spp.	species (plural)
SRC	Swan River Chert
RSM	Royal Saskatchewan Museum
rcybp	radiocarbon years before present (1950)
vert.	vertebrae

CHAPTER ONE

INTRODUCTION, STATEMENT OF OBJECTIVES AND CHAPTER OUTLINE

1.1 Introduction

For decades Plains archaeologists have attempted to connect various archaeological cultural complexes to one another using artifact assemblages gathered from a large number of known archaeological sites. Within a given time period, however, the number of components that can realistically be linked spatially, temporally and typologically is relatively small. Small samples or poorly represented archaeological material can be difficult to interpret and, certainly, as more data are collected interpretations change. Technological advances within the discipline can lead to new methods of study or to the refinement of old methods which, in turn, lead to modified interpretations of existing data. All of these factors led to this reinterpretation of an artifact assemblage that was excavated at the Oxbow Dam site (DhMn-1) in southeastern Saskatchewan (Figure 1.1) in 1956 (Nero and McCorquodale 1958).

Before proceeding further, it should be noted that problems exist involving classificatory schemes used to organize Plains archaeological cultural material. Several taxonomies have been presented, each supported by groups of partisan archaeologists, with the result that Plains archaeology is without a standardized nomenclature or a universally accepted taxonomic

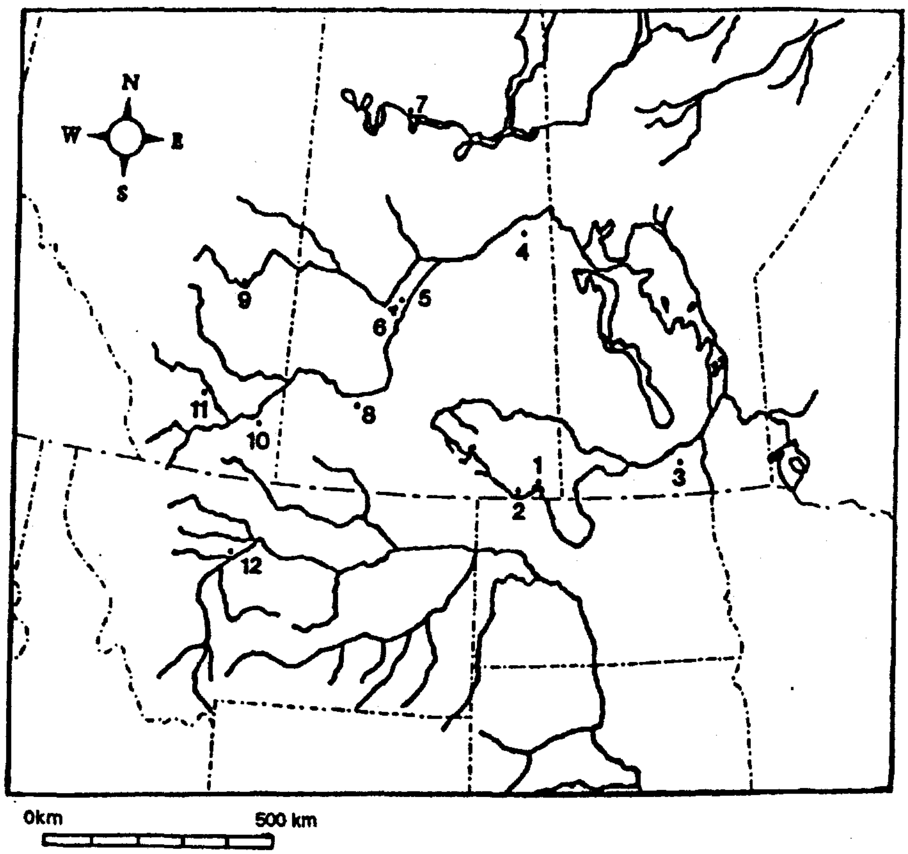


Figure 1.1: Map of the Northern Plains showing the locations of Oxbow complex sites mentioned in the text. **1**: Oxbow Dam site (Nero and McCorquodale 1958), **2**: Long Creek site (Wettlaufer and Mayer-Oakes 1960), **3**: Hacault site (Nero 1997), **4**: Connell Creek site (Meyer and Dyck 1968), **5**: Amisk site (Amundson 1986), **6**: (corresponds to three sites) Harder site (Dyck 1970, 1977, Morlan 1994a), Moon Lake site (Dyck 1970), Carruthers site (Dyck 1977), **7**: McCallum site (Meyer 1981b), **8**: Gray site (Millar 1978), **9**: Castor Creek site (Wormington and Forbis 1965), **10**: Southridge site (Brumley 1981, Vickers 1986), **11**: Majorville Cairn and Medicine Wheel site (Calder 1977), **12**: Sun River site (Greiser *et al.* 1985). Map adapted from Walker (1992).

system. This being the case, it is imperative that the particular taxonomic system used for each application must be identified and any terminology specific to the system must be defined in order to avoid possible confusion. The taxonomy utilized within this document roughly follows that of Dyck

(1983), where archaeological cultural 'complexes' are somewhat equivalent to 'phases' as defined by Willey and Phillips (1970). Within this system, a complex is defined as follows:

> A ***complex*** is a large composite archaeological unit. It consists of interconnected sites, features, and artifacts, tied together by similarities in function, style, technology, and subsistence-settlement system. The parts of a complex are found within a common geographical distribution and within a common segment of time (Dyck 1983: 69).

Dyck (1983: 69) further notes that a complex may or may not be equivalent to ethnological groupings. Similarly, Willey and Phillips (1970) define a phase as follows:

> ... an archaeological unit possessing traits sufficiently characteristic to distinguish it from all other units similarly conceived, whether of the same or other cultures or civilizations, spatially limited to the order of magnitude of a locality or region and chronologically limited to a relatively brief interval of time (Willey and Phillips 1970:22).

Within the aforementioned systems, phases or complexes can be linked together by **traditions**, where traditions are defined as recognizable elements of complexes which span several sequential complexes (Dyck 1983: 69). Reeves (1969: 19) makes a distinction between complexes and phases in that both are conceived as basic identifiable archaeological units with specific spatial and temporal distributions and cohesive technological adaptations, but when these units can be satisfactorily linked together by cultural traditions, Reeves (1969: 19) uses the term 'phase' while 'complex' is used when no connections can be made. Using Reeves' (1969) definitions, a complex could be viewed as a poorly understood phase.

In 1993, Richard Morlan published an article which was, in effect, a critical re-evaluation of Saskatchewan's cultural chronology as it is represented by radiocarbon dates. Morlan (1993: 3) pointed out that the chronology is based on a "powerful triumvirate" comprised of stratigraphy, projectile point typology, and radiocarbon dating. As such, the triumvirate is potentially very strong when all three parts support one another. Generally, archaeological complexes are strengthened as more supporting data is collected, usually in the form of excavated sites with well documented stratigraphy, diagnostic artifacts, and radiocarbon dates. Conversely, the triumvirate is weakened when any one of the constituents does not support the others. Taking Morlan's concept one step further, archaeological complexes are inherently at their weakest when they are initially defined as data to support or refute the notion of complex may not yet exist and therefore judgment can often only be passed with the benefit of many years of cumulative research on the subject. The Oxbow complex is certainly no exception to this idea.

1.2 Statement of Objectives

This thesis presents the results of excavations conducted at the Oxbow Dam site (Figure 1.1) during 1995 and 1996 as well as a reinterpretation, based on the newly acquired data, of an influential assemblage recovered from the site in 1956 by staff members of the Saskatchewan Museum of Natural History (now the Royal Saskatchewan Museum). Although several cultural components exist at the site, the emphasis here is on an Oxbow complex assemblage associated with cultural level six. The Oxbow complex is currently regarded as a highly adaptable, nomadic bison-hunting complex that originated on the Northern Plains during mid-Holocene, having developed out of grasslands-adapted complexes of the Mummy Cave series. The date of origin is, at present, an unresolved issue but several temporal spans for the complex have been presented. Two of these include Dyck's (1983: 96) temporal boundaries of 4700 to 3050 radiocarbon years before present (which is roughly equivalent to 5400 to 3300 calendar years before present when calibrated) and Morlan's (1993) estimate of 6300 to 4400 calendar years before present (BP). The differences between these two examples are due, in part, to advances made in radiocarbon dating technology and to an increasing number of dated components attributed to the complex. They also reflect the difference between the classificatory systems used by 'lumpers' and 'splitters', each selecting a different time for where the division should be made between Mummy Cave series complexes and later Oxbow complexes. The term *series* is used to indicate that several sequential complexes exist within the conglomeration of mid-Holocene cultural components referred to as Mummy Cave (Dyck 1983: 92). Dyck (1983) categorizes early Oxbow assemblages as late Mummy Cave while Morlan (1993) classifies late Mummy Cave assemblages as early Oxbow. The first half of Dyck's (1983) temporal range corresponds to the majority of Oxbow components found within the Northern Plains and the latter half emphasizes an overlap with McKean complex assemblages in the region. Morlan's (1993) span, on the other hand, emphasizes the connection between late Mummy Cave complexes and early Oxbow components as is reflected in subsistence adaptation and technology while down-playing the Oxbow~McKean complex overlap.

A taxonomic problem exists with the artifact assemblage from DhMn-1. When the deposits were first recognized and described in the late 1950s, they became instrumental in formally defining the Oxbow complex and, as such, the location has long been recognized as the type site for the complex. Subsequent research at other Oxbow sites, however, has led many archaeologists (Reeves 1973, Dyck 1983, Frison 1991, Walker 1992, Morlan 1993) to the conclusion either that DhMn-1 is an example of a very early Oxbow complex campsite likely representing a transitional period assemblage which contains Mummy Cave-like artifacts and Oxbow artifacts or that the assemblage is not Oxbow at all. Implying that the type site is not actually of the complex that it defines is logically problematic. This assemblage was originally dated to S-44: 5200 +/- 130 radiocarbon years before present (rcybp) (Nero and McCorquodale 1958). When calibrated to calendar years, this changes to approximately 6000 years old. It is proposed here that the assemblage only gives the appearance of an early, transitional form of the Oxbow complex and that this is the result of a combination of mixed components, a contaminated radiocarbon sample and the common but incorrect assumption that all of the material came from a single component directly associated with ash and charcoal used to date the site (see Millar 1981b: 85, Nero 1997). In other words, the assemblage commonly viewed as 'proto-Oxbow' or late Mummy Cave is more likely a conglomeration of material from both earlier and later periods associated with a contaminated radiocarbon date, all erroneously forged into a single occupation. When these factors are taken into consideration, the problematic cultural material can be separated and assigned to various components that were noted during the recent excavations and the original radiocarbon date can be discarded based on two new radiocarbon assays run on solubilized bone collagen collected from stratigraphically isolated levels.

The situation is further complicated because a much larger sample of material from an excavation at the Long Creek site (DgMr-1) (Wettlaufer and Mayer-Oakes 1960), located approximately 60 kilometers west of the Oxbow Dam site, was also used to supplement the DhMn-1 sample and define the complex. Therefore, the Oxbow Dam site is considered the type site of the complex but actually, many of the defining characteristics were based on assemblages from levels 7 and 8 at Long Creek. At the time, this all seemed very reasonable. In retrospect, however, many researchers (Reeves 1973, Meyer 1981b, Quigg 1984) have noted that level 8 at Long Creek, the primary source of diagnostic artifacts for the original definition of the complex, doesn't fit directly into the Oxbow complex either.

The 1995 and 1996 excavations were carried out at DhMn-1 to try to answer the question of when and how the Oxbow Dam site assemblage fits into Plains prehistory. Based on new information, it now appears that there may have been unforeseeable problems with the 1956 tests. During 1995 and 1996, sixteen one by one meter units were excavated to below the Oxbow level at DhMn-1. A number of discrepancies were readily apparent and the recent findings refute past speculations that the site is a very early Oxbow complex site in transition from an earlier form. The new excavation revealed that a series of cultural levels were present above the Oxbow component, and, perhaps more importantly, that a poorly developed palaeosol existed approximately 5 cm beneath it. It is possible that the original date, S-44: cal 6177 [5947] 5769 BP (Morlan 1993), was derived from an ash sample that was contaminated by older material from the palaeosol underlying the Oxbow component.

Apart from attempting to prove or disprove the aforementioned premise on Oxbow origins regarding the Oxbow Dam site, the recent excavations at DhMn-1 also add to our knowledge base for the complex. Oxbow vintage artifacts are commonplace on the Northern Plains but the number of excavated Oxbow components is actually fairly small. The recent excavation of DhMn-1 indicates that Oxbow people relied on a varied diet which occasionally included canids, rodents, birds, and reptiles and probably a number of plants. Dyck (1970, 1977, 1983) conducted extensive research on the Oxbow complex which raised questions regarding the hunting practices followed by Oxbow groups. In particular, Dyck (1977) speculated that the lack of identified Oxbow kill sites may reflect a hunting strategy that involved only small-scale bison kills where very few individual animals were procured during any single event, although he proposed that a small communal hunt may have been responsible for the assemblage represented at the Harder site in south central Saskatchewan. Subsequent research by Morlan (1994a) suggests that the Harder site assemblage more likely represents several small-scale bison kills. This form of hunting strategy appears to have been successfully employed by antecedent Mummy Cave series populations on the grasslands. This continuity is viewed as support for the proposition that the Oxbow complex developed out of a regional variant of the Mummy Cave series (Reeves 1973, Walker 1992). As part of the current research, a review of a number of Oxbow assemblages has been conducted with this research question in mind. It is hoped that the information presented here will help synthesize the current thinking on the

Oxbow complex while introducing new data in a useable format for future researchers.

1.3 Chapter Outline

Chapter one introduces the research problem dealt with in this thesis as well as presenting a synopsis of the contents of each chapter. Chapter two describes the physical setting of DhMn-1 including information on the geomorphological history of the location. The modern climate of the area is discussed as are native flora and fauna. A brief discussion of the hydrology of the region is presented which includes a section on the basic principles involved in regional flooding and information on flood severity and frequency in the Oxbow vicinity. This information provides context for the excavation as well as for the Precontact occupations of the Oxbow Dam site.

Chapter three is an overview of southern Saskatchewan's Precontact cultural history. The chapter also describes various gross classificatory systems developed to aid in the spatial and temporal interpretation of cultural complexes from the last 12,000 years. The chronology presented describes the prominent complexes from the Palaeoindian, Middle Precontact and Late Precontact Periods. Major technological developments, subsistence economies, and temporal spans are presented for each complex. It should be noted that the level of understanding of different complexes is highly variable and the amount of data presented for each one reflects this variability.

A historical background regarding previous research conducted at DhMn-1 is presented in chapter four. The chapter includes information on the initial discovery of the site as well as the research methods used by the Saskatchewan Museum of Natural History (SMNH) investigators in 1956 (Nero and McCorquodale 1958). Also included is a review of the Oxbow components from the Long Creek site (Wettlaufer and Mayer-Oakes 1960) that Wettlaufer (1960a) used in conjunction with the assemblage from the Oxbow Dam site to define the Oxbow 'culture.' The radiocarbon dates from levels assigned to the Oxbow complex from both sites are critically evaluated for possible sources of contamination. Chapter four contains an outline of the field and laboratory procedures followed for the excavation conducted at DhMn-1 in 1995 and 1996 by the University of Saskatchewan. Finally, information on the condition of DhMn-1 is presented.

Chapter five presents a basic analysis of site stratigraphy as it relates to the cultural components recovered at DhMn-1 in 1995 and 1996. The effects of floods as they are represented by strata are discussed. Descriptions of sediment matrices are presented including rudimentary classifications of particle size (ie: clay, silt, sand, gravel), colour, and texture. Any non-human, biological, sediment-disturbing processes (bioturbations) that were noted during the excavation are discussed within chapter five. This chapter contains an outline of Morlan's (1993) criteria for presenting radiocarbon dates as an introduction to the dates from levels six and seven at DhMn-1 resulting from the 1996 excavation.

Chapters six and seven each deal with the cultural assemblages recovered from DhMn-1. Descriptions of the assemblages from the cultural levels are presented in chapter six. Each cultural component is discussed individually with sections relating to lithic, faunal, and feature analysis. Every attempt has been made to relate these levels to cultural complexes. Levels five and six contain large enough assemblages to make some conclusions about the complexes they reflect. Chapter six contains statistical information on species frequencies, cultural modification of faunal elements, feature analysis, and lithic tool metric analysis, as this knowledge reflects activity areas at the site. Following the analysis of lithics, faunal remains and features from each level is a discussion and summary of the findings. Similarly, chapter seven presents a re-analysis of material recovered from the site by Saskatchewan Museum of Natural History staff members in 1956. The chapter attempts to clarify issues regarding the provenience of faunal and lithic material by referring to original fieldnotes, in-house reports and many previously unpublished photographs from the initial work.

Chapter eight is an overview of the current opinions about the Oxbow complex. The chapter is organized chronologically to present theoretical developments regarding the complex in a logical progression. Synopses of research conducted at various sites are incorporated into the chapter. Moreover, this chapter discusses the Oxbow component of DhMn-1 as it relates to other Oxbow complex sites on the Northern Plains and adjacent areas. A summary of the 1995-1996 research at DhMn-1 is given in chapter nine. This chapter also includes brief summaries of each cultural level and conclusions about the research conducted as it relates to the objectives stated in chapter one. Part and parcel of this is a discussion of how the Oxbow complex is expressed at DhMn-1 and how the results from the site add to our current understanding of the complex.

CHAPTER TWO
SITE PHYSIOGRAPHY

2.1 Site Location and Legal Land Description

The Oxbow Dam site (DhMn-1) is located on the east bank of the Souris River in LSD 15, NE. 1/4 of Section 14-3-2-W2 in the R.M. of Enniskillen approximately 1.6 kilometres south of the town of Oxbow, Saskatchewan (Figure 2.1). The land is currently owned by Gertrude Workman and her son Lorne. Previously the land was the property of J.A. Workman during the time of the Saskatchewan Museum of Natural History excavations in 1956. The 1995-1996 excavation block (Plate 2.1) was placed along the edge of the cutbank of a Holocene alluvial step or terrace created as the Souris River downcut and abandoned this portion of floodplain during the mid to late Holocene (McFaul 1990). The block is approximately 45 meters southeast of the northeast corner of the dam.

The terrace is bordered to the north by a steep-sided coulee which drains into the river at the foot of a small dam (or weir) for which the site gets its name. The terrace has been extensively modified by recent human activity over several decades, including serving as a borrow area for dam construction in 1938 (Jack Dalziel pers. com. 1996). It was later graded during road construction to build a ford across the river, and finally was further reworked during the installation of an oil pipeline which bisects the site into

North and South halves (John Voutour pers. com. 1995). Repeated floods have also been a major destructive force affecting the terrace.

Plate 2.1: View looking southeast toward the site from west bank of the Souris River. Wooden structure at left is the dam built in the early 1960s. The earlier dam is visible as a straight line of debris at the water surface just in front the reeds.

Richards (1969: 41) refers to the surrounding area as the Souris Plain which is a component of the Central Saskatchewan Plains of the Saskatchewan Plains Region. This is, in turn, a component of the Central Lowlands Province. Osterkamp *et al.* (1987: 163) note that the Saskatchewan Plains are generally considered to be part of the Great Plains. The area is toward the eastern edge of the Palliser Triangle (Wilson and Dijks 1993).

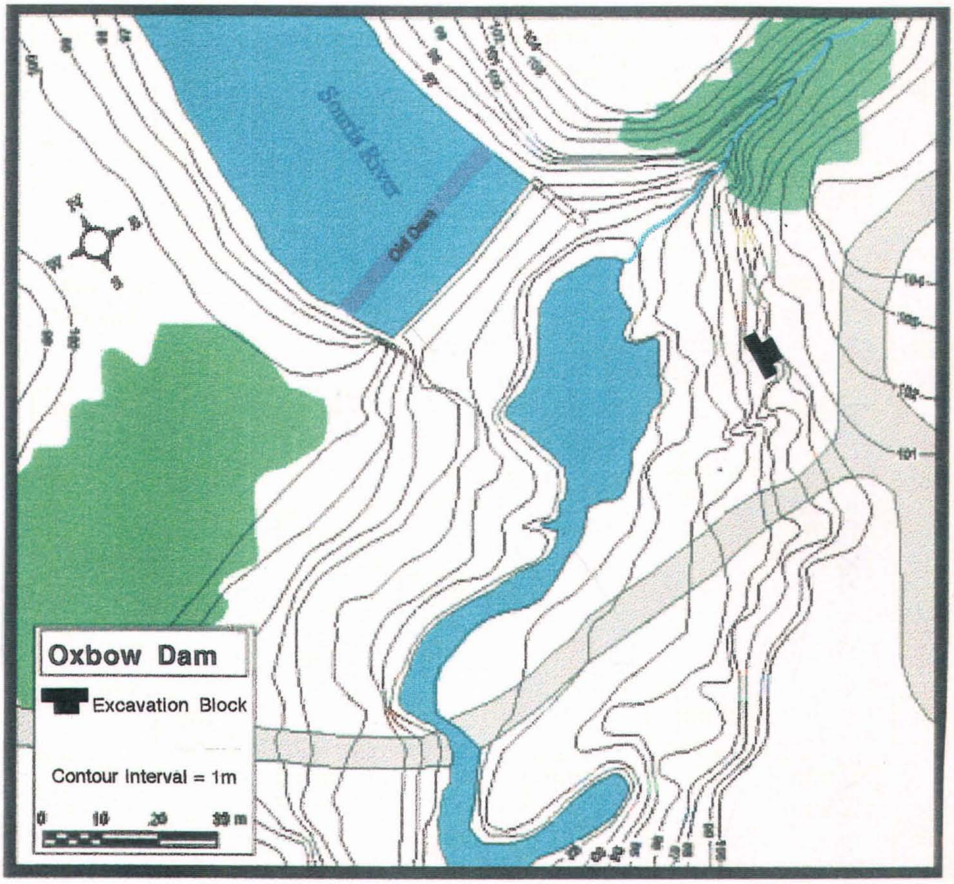


Figure 2.1: High resolution topographic map of the immediate area of DhMn-1 showing relationship of 1996 excavation block to the dam, road and river. Data for the map was collected during the initial exploratory phase in 1995 and compiled and digitized by M. Magee.

Glacial advance and retreat is overwhelmingly responsible for the landscape of the area. The Souris Plain is made up of extensive areas of till plain containing "hummocky and ribbed ground moraine and local lake plains"(Richards 1969: 41). Hummocks formed as stagnant glaciers melted and the debris trapped within the aptly named "dead ice" was unloaded as the ice/debris matrix disintegrated (Kupsch 1969: 48). Similarly, ribbed ground moraine was formed as a stagnating or slowly receding glacial mass deposited successive 'ribs' of material.

2.2 Physiography of the Souris River Valley

The Souris Basin Development Authority (S.B.D.A), states that the Souris River Valley is the result of glacial meltwater incising a channel into the Souris Plain (S.B.D.A. 1989:14). The valley is approximately 30 m deep and one km wide (S.B.D.A. 1989b: 14). As the Laurentide Ice Sheet retreated approximately 12,000 years ago, large, highly unstable lakes formed along the spillway (Lord and Kehew 1990). Kehew and Clayton (1983:187-209) suggest that large portions of the Souris River Valley were expanded and/or created during the extremely rapid discharge of Glacial Lake Regina between 12,000 and 11,000 years ago. A tremendous volume of water drained from the lake at an hypothesized rate of between 100,000 and 1,000,000 cubic metres per second. The water flooded Lake Souris and Lake Hind in succession, before making its way to Lake Agassiz. Boettger (1986) states that the enormous volume of water discharged from the lakes scoured the channel to a depth of almost 50 meters. However, mass wasting along the sides of the valley caused high rates of aggradation. The rapid expansion of existing segments of the valley system created terrace-like features on the inner meander of the valley just south of the town of Oxbow approximately 1.5 km west of DhMn-1 (Kehew and Clayton 1983). By the middle Holocene, the Souris River was similar to the present river in size but alluvial fan deposits, created as tributaries eroded the valley walls, dammed the river in places causing long, shallow lakes to form (Lord and Kehew 1990: 13).

The present day Souris River is an underfit stream (Kupsch 1969: 49) less than 20 meters wide and usually less than 2 m deep (S.B.D.A. 1989b: 14), which originates in the Yellow Grass marshlands near the town of Weyburn, Saskatchewan. It is fed by two main tributaries, Moose Mountain Creek and Long Creek, before it reaches the area of DhMn-1. The Souris River then continues to meander through the valley, crossing into North Dakota before turning northward into Manitoba. The valley contains numerous abandoned channels which appear as oxbow lakes easily visible in airphotos. Meandering rivers and streams gradually shift their location, swinging back and forth across a valley floor over several centuries or millennia. As the Souris migrates eastward at the site location, it erodes more and more of the cutbank where the site was first detected. This constant erosional pressure has caused the bank to slump in areas effectively compressing the strata in certain portions of the site.

2.3 Climate and Hydrology

The Souris Basin Development Authority (1989b: 25) describes the climate of the area as semi-arid continental with extreme variation in temperature and precipitation. Temperature can drop to -40° Celsius during winter months, occasionally reaching highs of +40° Celsius during the warmest summer months. Precipitation for the immediate Oxbow area can be extremely variable from month to month and year to year. According to recent records for example, the Oxbow area has an annual precipitation of 408 mm which ranges from a mean monthly low of 17 mm in January to a high of 69 mm in June (S.B.D.A. 1989b: 26). About 55% of the annual precipitation occurs between May and August. Record rainfall for a 24 hr period is 104.1 mm. Summer rainfall apparently contributes little to stream flow, the majority of which (85%) comes from snowmelt (S.B.D.A. 1989b: 26).

Stream flow for the Souris River is highly variable with peak discharges occurring in early to mid-April (S.B.D.A. 1989b: 37). Trends show that it is the spring thaw in combination with ice jams that causes large scale flooding along the river. Hydrological data from the Souris River Basin Authority studies suggest that the majority of the floods are due to rapid and extremely high discharge from Moose Mountain Creek rather than to the Souris River itself. The area of DhMn-1 is highly prone to flooding in that it is located only a short distance downstream from the confluence of these two systems. Large scale floods occur in the site area when both the Souris River and Moose Mountain Creek reach peak discharge rates. The creek contributes approximately one quarter of the annual flow of the Souris downstream at the Sherwood recording station (S.B.D.A. 1989b: 36). As much as 82% of the annual flow from Moose Mountain Creek occurs during the early spring and summer months. Over the last century, studies of discharge rates indicate that floods can occur several times within a single decade with major flood events happening every few decades.

While the Souris River is slow-flowing and meandering, Moose Mountain Creek could be classified as a straight to proto-sinuous channel (as defined by Brown 1997: 63-65) generating a faster flow rate, particularly during spring thaw when large quantities of meltwater from Moose Mountain fill the drainage. During the spring, Moose Mountain Creek can also become heavily laden with sediment. Between 1974 and 1976 the mean daily load during April was 423 tonnes (S.B.D.A. 1989b: 37). However the highest recorded suspended sediment load was on April 9th, 1976, when the rate was recorded at 7,910 tonnes per day or 506 mg per litre. Such major occurrences have obvious implications for site formation processes as well as destructive processes. Of course, it is possible that modern agricultural practices have altered the pattern of flooding that existed in the area prior to the arrival of Europeans. As a result, the studies conducted by the Souris Basin Development Authority may not reflect pre-agricultural hydrology particularly with respect to sediment loads.

The terrace where DhMn-1 is situated is susceptible to 1 in 500 year flooding (S.B.D.A. 1989b). Generally, several factors are involved in large scale floods. Obviously, floods occur when discharge rates exceed the capacity of the drainage channel or system. The capacity of a drainage system may be altered when stream flow rates are impeded by ice, fallen trees and debris, or even beaver dams. Discharge rates are ultimately affected by climatic conditions including rapid temperature change and precipitation rates. According to Brown (1997:38-39), several conditions greatly affect the type of flood (ie: catastrophic or nuisance) as well as its impact. The size and slope of the catchment area, the drainage capabilities of the underlying site strata, along with the climatic regime of the area, are key elements in determining the type of flood. Harrison and Bluemle (1980:11-14) outlined the variables responsible for recent flooding along the Red River Valley in North Dakota. Their summary indicated that a wet fall season followed by a cold winter would effectively saturate the ground thus creating poor drainage conditions for the following spring. This in combination with unusually heavy snow accumulation during the winter followed by a cool, wet spring with a sudden warming trend, creates conditions where the already saturated ground will not absorb the moisture. Therefore the moisture is mainly distributed as meltwater and discharged through water courses that may be partially blocked by ice or other debris.

Many of the floods could be approximately dated using diagnostic artifacts and radiocarbon dating. Any dateable sequence of strata along the Souris River would certainly aid in interpreting the rich archaeological resources of the area as strikingly similar stratigraphic sequences are visible for several kilometers in either direction from the site location. Unfortunately, the hydrological studies of the river system conducted as part of the Rafferty-Alameda Dam Project stopped short of reconstructing flood patterns based on stratigraphy. This may prove to have been a major oversight as models used for predicting flood severity exclude several extremely destructive flood events in Middle to Late Precontact times.

There is great potential to learn more about the hydrology of the region by interpreting the strata. Dr. Elena Ponomorenko (pers. com. 1997) has suggested that studies of this nature would be greatly beneficial for our understanding of climatic regimes of the past. Furthermore, she has noted that there appears to be a consistent pattern of erosion and deposition at sites along the North Saskatchewan River and elsewhere where truncated paleosols and flood deposits precisely parallel the events along the Souris River. If the pattern can be detected throughout the province, it may prove to be a useful tool for dating riverside archaeological sites as well as reconstructing paleoenvironmental conditions. In any case, in-depth geoarchaeological studies of such fluvial environments within the province would greatly enhance our interpretation of the past.

2.4 Site Flora

The area in and around DhMn-1 is classified as the Aspen Grove Ecodistrict (S.B.D.A. 1989a) with *Populus tremuloides* (Trembling Aspen) and *Populus balsamifera* (Balsam Poplar) as the most common tree species represented and *Stipa spartea var. curtiseta* (Spear Grass) and *Agropyron dasystachyum* (Wheat Grass) as the common grasses. Having said that, the Souris River valley is a unique ecosystem that provides habitat for a variety of both plant and animal species not commonly found elsewhere in the region. Many areas along the Souris River near Oxbow have large numbers of *Quercus macrocarpa* (Bur Oak), *Acer negundo* (Box Elder), *Fraxinus pennsylvanica* (Green Ash), and *Ulmus americana* (American Elm) (Young and Kerr 1989). Species such as *Echinacea angustifolia* (Purple Coneflower), *Humulus lupulus* (Common Hop) and *Echinocystis lobata* (Wild Cucumber) were noted in the site area during the excavation. Young and Kerr (1989: 11) state that many of the plant species associated with the aforementioned hardwoods are more frequently found in areas to the southeast and note that this portion of the Souris River~Moose Mountain Creek drainage system marks the northern limit of many of those species. Harms (1989) identified 36 plants in the area that are considered rare in Saskatchewan, four of which are in the immediate vicinity of the site. These plants include *Carex gravida* (Heavy-fruited Sedge), *Bouteloua curtipendula* (Side-oats Grama), *Polygonatum biflorum* (Great Solomon's Seal) and *Helianthus tuberosus subcanesens* (Jerusalem Artichoke). Lower mesic areas are commonly covered with plants of the Mixed-grassland Association but contain some Tall-grass Association species (Harms 1989) like *Andropogon gerardi* (Big Bluestem) and *Panicum virgatum* (Switch Grass). Aquatic plants listed

(S.B.D.A. 1989a) for the area include species like *Circuta maculata* (Water Hemlock), numerous forms of *Scirpus spp.* (Bulrushes) and *Typha latifolia* (Cattail).

2.5 Site Fauna

The fauna of the Souris River valley is extremely diverse and includes species currently rarely found elsewhere in the province. Of particular note is the presence of *Chelydra serpentina* (Common Snapping Turtle), and *Chrysemys picta belli* (Western Painted Turtle). Other reptiles and amphibians include *Thamnophis spp.* (Garter Snake), *Ambystoma tigrinum* (Tiger Salamander), and *Rana pipiens* (Leopard Frog).

In the past, the area was populated with large mammals such as *Bison bison bison, Antilocapra americana* (Pronghorn) and *Cervus canadensis* (Elk). Large carnivores such as *Ursus arctos horribilis* (Plains Grizzly Bear) and *Canis lupus nubilis* (Buffalo Wolf) used to inhabit the region but, by the end of the nineteenth century, all had been extirpated (Banfield 1987). Currently, the only naturally occurring large ungulates in the area are *Odocoileus hemionus* (Mule Deer), and *Odocoileus virginianus* (White-tailed Deer)(S.B.D.A. 1987a). Small to medium sized mammals include *Lepus townsendii* (Jack Rabbit), *Canis latrans* (Coyote), *Vulpes vulpes* (Red Fox), *Taxidea taxus* (Badger), *Spermophilus richardsoni* (Richardson's Ground Squirrel), *Castor canadensis* (Beaver), *Ondatra zibethicus* (Muskrat), *Marmota monax* (Woodchuck), *Procyon lotor* (Raccoon), *Mustela vison* (Mink), and a wide variety of mice, shrews and voles such as *Clethrionomys gapperi* (Gapper's Red-backed Vole), *Microtus ochrogaster* (Prairie Vole), *Peromyscus leucopus* (White-footed Mouse), and *Microsorex hoyi* (Pigmy Shrew). The landowners reported watching a Cougar (*Felis concolor*) in their yard some weeks before the excavation was started.

Avifauna are equally diverse and include many wetland species such as *Ardea herodias* (Great Blue Heron), *Pelecanus erythrorhynchos* (American White Pelican), *Ceryle alcyon* (Belted Kingfisher) and several species of ducks, mergansers, and geese. Young and Kerr (1989:5-9) identified 5 species of rare birds in the river valley. This list includes *Accipiter cooperi* (Cooper's Hawk), *Sialia sialis* (Eastern Bluebird), *Buteo regalis* (Ferruginous Hawk), *Athene cunicularia* (Burrowing Owl), and *Lanius ludovicianus* (Loggerhead Shrike) (*For a more comprehensive list of recorded species for the area see S.B.D.A 1987a).

Determining exactly which fish are native to the Souris River system and which are introduced is difficult. It seems that although *Esox lucius* (Northern Pike), *Stizostedion v. vitreum* (Walleye), *Perca flavescens* (Yellow Perch), and *Ictalurus melas* (Black Bullhead) are common sport fish (Atton 1969: 83-84) along the Souris today, several may be introduced species although the literature is unclear. Many smaller species are important food resources for any number of birds, mammals and reptiles. This list includes *Pimephales promelas* (Fathead Minnow), *Notropis blennius* (River Shiner), and *Percina maculata* (Blackside Darter) to name but a few (Fernet 1988: 21-22). Other aquatic creatures such as crayfish, and fresh water clams inhabit the Souris River as well.

Of course, ultimately what the aforementioned 'lists' of flora, fauna, topography, and climatic regime are for, is establishing some form of context for the cultural material recovered at DhMn-1. It should be noted that significant changes have occurred to the resource base throughout the Holocene and ranges for flora and fauna have fluctuated. That being the case, many of the species noted above have been identified within the faunal assemblages of various levels from DhMn-1. Certainly bison and canid remains stand out as prominent subsistence resources during the Middle Precontact Period. Other remains that appear to have had some utility as food resources include woodchuck, turtle, pronghorn, merganser and various species of voles and mice. The turtle remains are significant in that they represent a relatively rare occurrence in Saskatchewan. This is undoubtedly due to their limited extreme southeastern range within the province. Hanna (1976) and Walker (E.G. Walker pers. com. 1997) report turtle remains from human burial contexts in southern Saskatchewan, but the remains from DhMn-1 appear to represent food items. The use of turtles as food has been well documented in both the ethnographic (Pond 1986:30; Lowie 1985:17; Grinnell 1972: 256,307-308; Cahn 1937:138; Russell and Bauer 1993:121) and archaeological literature (Drass and Flynn 1990:180,181; Drass and Moore 1987:408; Eighmy 1970:255-282; Johnson 1987:393; Fortier 1983: 257; Jefferies and Lynch 1983: 315-321) for areas to the south and east. Again, the reason why they are not documented in Saskatchewan ethnographies and archaeological site reports is because of their extremely limited range. In any case, they effectively establish the season of the Oxbow occupation as late Spring to early Fall when turtles are active. Invertebrates such as fresh water clams provided the raw material for pendants and other types of aesthetic objects and may also have served as food. Undoubtedly, some of the specimens are not culturally significant but are of archaeological importance as they can be used to help establish the environment at the times of each occupation. Unfortunately, many of the carbonized seeds collected from fine screen samples have deteriorated beyond the point of recognition and are therefore excluded from the analysis.

CHAPTER THREE
SOUTHERN SASKATCHEWAN'S PRE-CONTACT CULTURAL CHRONOLOGY

3.1 Background to the Chronology

In very broad terms, the vast majority of complexes on the Plains were pedestrian bison-hunting societies who utilized the dog as a pack animal and food source. The reliance on bison, though heavy, has probably been over emphasized due to biases in sampling techniques, differential preservation of large and small faunal remains, and a perpetuating stereotype that Plains peoples were strictly nomadic bison hunters in spite of ethnographic and archaeological evidence that suggests that a variety of subsistence strategies were utilized. The extent to which various groups were nomadic likely changed dramatically through time as well. Despite the concerted effort of dozens of archaeologists over several decades, much of what we understand of past cultures is fragmented to such an extent that the relationships between successive or even contemporaneous complexes is completely obscured. Without question, future research will produce plausible answers to heighten our understanding of the region's dynamic past. This review is a general synthesis of current ideas on the more notable complexes from various temporal stages.

A number of schemes exist that attempt to create a logical and orderly progression for gross categories of Plains cultural complexes. The idea behind these schemes is to reflect, in general terms, stylistic attributes of assemblages, proposed technological adaptations, changing environmental conditions, and to create a temporal and spatial framework to aid in our interpretation of Plains material culture. This is rather a daunting task and consequently no system is without its shortcomings. Walker (1992) evaluated the systems of Mulloy (1958), Wheeler (1958), Malouf (1960), Wormington and Forbis (1965), Frison (1978), Dyck (1983) and Reeves (1973) and generated a hybrid taxonomy by combining the terminology of Frison (1978) and Reeves (1973) in hopes of more accurately reflecting the cultural adaptations represented in Southern Saskatchewan. In particular, Walker (1992) used terminology which substituted Reeve's (1973) Middle Precontact (Prehistoric) Period for Frison's Plains Archaic Period because the archaic foraging lifeway present in the Great Basin, areas of Wyoming, and the Eastern U.S., where the diversity of food resources was extensive, is much less pronounced on the Northern Plains. Walker's (1992) taxonomy is followed in this document generally supporting the idea of continued bison-based economies throughout the Middle Precontact Period but also recognizing that increased variation and intensification of resource utilization did occur in specific biomes.

It should be noted, however, that the concept of a 'Plains Archaic' was first proposed by William Mayer-Oakes, one of the principal investigators at the Long Creek site (DgMr-1), in southeastern Saskatchewan (1959: 146-156, 1960b: 580-587). His (Mayer-Oakes 1959:151, 1960a:115-118) formalization of the concept was based on work conducted in the American Midwest and its speculated relationship to Eastern Plains manifestations including materials recovered from levels 5 through 9 at Long Creek, some of which Wettlaufer had assigned to the 'Oxbow Culture' (Wettlaufer 1960a). Frison's (1991:20-21) use of the term "Plains Archaic" and Mayer-Oakes' (1959:146-156) original concept have fundamental differences in that Frison uses the term to refer to subsistence technology used and adapted for foothills and mountain areas of the Northwestern Plains periphery while Mayer-Oakes explicitly states the 'Plains Archaic' represents a blending of subsistence technology in the "prairie-woodland transition zone" on the eastern periphery.

The period from initial human occupation, 12,000 years ago, to the beginning of the Altithermal, 7500 years ago (Antevs 1955), is referred to as the Paleoindian Period. The term 'Altithermal' refers to a time-transgressive climatic episode, lasting 2500 years or more, that was generally expressed as increased average temperatures and aridity across North America. This will be discussed further in chapter five. The Altithermal corresponds to the Early Middle Precontact Period lasting until roughly 5000 years ago. Temperatures began to ameliorate by the start of the Middle Middle Precontact Period which lasted until approximately 3000 years ago. This was, of course, followed by the Late Middle Precontact Period lasting until approximately 2,000 years ago (Walker 1992). The Late Precontact Period (ca 2000 BP to 300 BP) is delineated by the adoption of pottery and the bow and arrow although Dyck and Morlan (1995: 537) have recently proposed that the bow was adopted much earlier than 2000 BP. Finally, the Proto-Historic and Historic Periods are represented in Saskatchewan by material from about the last three hundred years.

3.2 Southern Saskatchewan's Cultural Chronology

We know from artifacts recovered in surface collections that human occupation of Saskatchewan began as glaciers were retreating northward or very shortly thereafter. Clovis and its contemporary Goshen complex, are both present in collections within the province suggesting an entry time for human occupants sometime around 11,500 years ago based on excavated components in other Northern Plains areas (Frison 1991). Ecologically, the area was in a state of rapid change during the initial Paleoindian Period as huge lakes and valleys were formed as the glaciers melted. Plant and animal communities quickly developed as climatic conditions became more favourable. The cultural groups of the time were big game hunters who utilized mammoth and *Bison antiquus* and *Bison occidentalis* as primary food sources (see Wyckoff and Dalquest 1997). No mammoth killsites have yet been identified within the province. As mammoth became extinct, cultural changes took place with Clovis and Goshen complexes giving way to bison-hunting Folsom and Midland complexes. As with the earlier assemblages, Folsom artifacts, which usually date to around 10, 500 years ago, exist only in surface collections within the province.

Later Paleoindian complexes are represented by large surface collections such as the Parkhill Site assemblage of 137 Agate Basin projectile points or bifaces (Ebell 1980: 4), and the McLeod Site collection of 76 Cody complex projectile points (Joyes 1997). The most comprehensive data for regional Paleoindian material comes from excavated sites such as the Niska Site (Meyer 1985), or the Heron Eden Bison Kill (Corbeil 1995). At the latter, numerous examples of Cody complex artifacts were recovered from a bone bed near the Great Sand Hills of southwestern Saskatchewan, radiocarbon dated to approximately 9,000 years ago. Corbeil (1995: 70-71) suggests that the form of bison represented at the Heron Eden Site is likely an extinct form, *B.b. antiquus*. Lesser known parallel-oblique-flaked lanceolate points, known as 'Angostura' and 'James Allen' points, have been collected in southeastern areas of the province.

A characteristic of Paleoindian lithic tools is that they usually exhibit a high degree of flintknapping skill and are arguably among the best stone tools ever produced anywhere in the world. Not surprisingly, Paleoindian groups favored high-grade cryptocrystalline rocks, like Knife River Flint from North Dakota, for their projectile points and they were willing to travel or trade over great distances to get it (Ahler 1986:5; Gregg 1987: 369-371, Goodyear 1989: 2). Goodyear (1989) notes that the size and shape of Paleoindian projectile points, especially needle-like Eden points, allowed for their use as knives and drills as well, and that broken points could often be rejuvenated into a functional state with minor retouching. In other words, a spear point, particularly when attached to a short foreshaft like those recovered from southwestern Montana (Lahren and Bonnichsen 1974), was an adequate toolkit in and of itself.

While the evidence for Paleoindian occupation in the province is reasonably well documented, sites and artifacts from the Early Middle Precontact Period, 7500-5000 years ago are relatively rare. This period is distinguished from the Paleoindian Period by the replacement of stemmed and lanceolate projectile points with smaller side-notched varieties (Frison 1991: 79), possibly indicative of a technological shift in hunting weaponry involving the spread of the atlatl although such technology may have existed during Paleoindian times. Certainly, climatic changes during this period made many areas of the Plains less hospitable than they had been and for this reason human population in the area probably fluctuated dramatically. Reeves (1973) proposed several reasons for the shortage of sites dating to the Altithermal, suggesting that geomorphological processes related to increased aridity caused the destruction or deep burial of deposits or that archaeologists are simply unable to differentiate between Early Middle Precontact Period projectile points and later side-notched varieties. Plains assemblages from this period have been referred to the Mummy Cave *complex* by Reeves (1978) while Dyck (1983) prefers the term Mummy Cave *series* recognizing that a number of similar complexes existed between 7700 and 4700 rcybp. Both variations imply continuity between western Mountains-Foothills complexes and Plains complexes. Alternatively, Forbis (1992: 40) argues for the use of the term "Gowen" rather than "Mummy Cave" when referring to materials from sites on the short-grass Plains thus differentiating the prairie expressions of the Early Middle Precontact Period from it's western counterparts. Morlan (1993: 37) presents a much shorter duration for the Mummy Cave series as it is represented in the province (cal 7000 - 6300 BP) because of a lack of available and reliable radiocarbon dates for the period. Ultimately, the origins of the Early Side-Notched projectile points in the western Mountains-Foothill areas as well as the Plains may be from the East where side-notched projectile points are of considerable antiquity.

A key element of Early Middle Precontact Period subsistence is an hypothesized intensification of resource utilization including an increased reliance on plants and small vertebrates in some areas, and a maximization of recovered proteins and fats from animal carcasses (Frison 1991: 84, Walker 1992: 144). Within the past decade or so, several attempts have been made to recover and identify fragile plant and microvertebrate evidence from sites within the province using flotation, water screening, plant macrofossil analysis, and microvertebrate analysis (Walker, Mack, and Webster 1997, Ramsay 1993, Corbeil 1995). Hunting strategies used during this period probably involved a much heavier reliance on opportunistic kills of individual animals or small groups of animals. Walker (1992: 129-130) reports that faunal assemblages from sites of this vintage are often small and many of the reported sites probably represent short-term camps.

Components from this period have been identified in the Saskatoon area at the Gowen sites I and II (Walker 1992), and the Norby site (Zurburg 1991), all of which date between 6,000 and 7,000 calendar years ago (Morlan 1993: 26), and are located on the Saskatoon Terrace. Faunal remains from Gowen I and II indicate that animals were thoroughly processed to extract all usable nutrients (Walker 1992: 97-109) implying that food resources were not as abundant on the Plains as they had been. Further evidence for human occupation of the region during the Altithermal exists at the Camp Rayner Site (EgNr-2), located along the edge of the Lake Diefenbaker Reservoir in south-central Saskatchewan. The site contains side-notched and corner-notched atlatl dart tips from strata between Oxbow material and earlier lanceolate Paleoindian artifacts (Tim Jones pers. com.). The points are thick and generally spade-shaped with convex lateral margins and straight to convex bases. Some have notches that angle toward the tip giving the shoulders a barbed appearance. The analysis of material from

Rayner is eagerly anticipated as the site will undoubtedly help answer questions about this little known time period on the Northern Plains. Of course, the Oxbow Dam Site (Nero and McCorquodale 1958) is often attributed to this time period as well, although the original age of 5200+/-130 rcybp (S-44: cal 6289 [5947] 5655 BP: Morlan 1993: 11) has been called into question here.

By the Middle Middle Precontact Period, 5,000-3,000 years ago (Walker 1992), human populations on the Northern Plains seem to have been on the rise. A continuation of a bison-based subsistence economy occurred in Southern Saskatchewan although the diet was supplemented with plant foods and a wide range of small and medium mammals including dogs. The Oxbow complex dominates this period and is well represented in surface collections and excavated sites throughout the province in the boreal forest, the sand hills, and the open grasslands. Dyck (1983: 96) suggests a temporal span for the complex of 4700 to 3050 rcybp in Saskatchewan. Morlan (1993: 38) has since revised the time span to range from 6300 to 4400 calendar years BP suggesting that the Oxbow complex was already developed and in place as the Altithermal came to a close and climates became more stable. This melds well with ideas put forth by Walker (1992) that the Oxbow complex was an *in situ* development out of a local variant of the Mummy Cave series, like Gowen. However, other complexes undoubtedly had strong influences on the burgeoning Oxbow complex. A review of Oxbow radiocarbon dates is presented in Appendix A.

Faunal assemblages suggest that the peoples of the Oxbow complex utilized a subsistence economy heavily reliant upon bison. Ironically, however, no well documented bison kill sites from this period exist in Western Canada. The hunting strategies used during this period are speculative but the majority of Oxbow assemblages indicate that small-scale hunts, where very few bison were killed in any single event, appear to have been the norm during this period. Dyck (1977: 55-56) had originally proposed that some form of communal hunt using a natural depression, or a constructed pound, or even a human surround was likely, based on numbers of individual bison represented at the Harder site. A re-examination of the Harder site faunal assemblage (Morlan 1994a) suggests that all of the 17 bison represented in the sample were likely killed in several small-scale hunts rather than a large communal kill as first proposed. This is not to say that Oxbow complex peoples were exclusively bison hunters. On the contrary, recently excavated faunal remains from the Oxbow Dam site (see chapter 6) indicate a very diverse diet.

As a cultural entity, Oxbow seems to have been rich with ceremonialism. Calder (1977) demonstrated that the origins of the Majorville Cairn and Medicine Wheel in southern Alberta, probably began during Oxbow times. Oxbow interment of the dead often involved multiple burials associated with domestic dog burials (Savage 1974) and large amounts of red ochre (Millar 1981: 105). The Gray site burial assemblage, which contained the remains of over 300 individuals, has recently been repatriated. Records show that it contained marvelous examples of non-utilitarian items such as native copper tube beads (Millar *et al.* 1972: 29, Millar 1978, 1981: 105) and east coast shell necklace parts that could only have been available through long-distance trade networks. The site assemblage also appears to contain materials that are not of the Oxbow complex. Radiocarbon dates from the site are problematic (Appendix A) but they seem to indicate a long presence for, perhaps, a series of related Middle Precontact complexes which includes Oxbow and possibly an unidentified but related complex in the Mummy Cave series.

There is some evidence to suggest that a northward and eastward movement out of the grasslands/parklands and into forested areas occurred during late Oxbow times (Spurling and Ball 1981:89-102). This may have been in response to movements of populations of largely coeval McKean/Duncan/Hanna complex people although the nature of this relationship is poorly understood at present. The projectile points from this complex include a concave-based, unnotched lanceolate form known as 'McKean', a lanceolate point with convex lateral edges and a pseudo-stemmed base referred to as 'Duncan', and a stemmed triangular point with steep shoulders and a flaring base named 'Hanna'. Disagreement about the temporal span of the McKean/Duncan/Hanna complex exists with Dyck (1983) suggesting something like 4150-3100 rcybp and Morlan (1993) and Frison (1991) supporting a longer span on the order of 5000-3200 BP or more (Ramsay 1993). McKean seems to be a genuinely western phenomenon possibly developing out of the Great Basin or the eastern slopes of the Rockies where this cultural group had developed a subsistence economy based on foraging. Some speculate that McKean peoples were in competition with Oxbow groups (Walker, pers. com.), while others see McKean as slowly replacing the Oxbow complex in Saskatchewan (Morlan 1993: 38-39) and still others see an evolutionary relationship where McKean grew out of Oxbow (Wright 1995: 302). This last concept is largely based on the close resemblance of a McKean point to an unnotched Oxbow preform.

Almost without exception at stratified sites where both complexes exist, Oxbow materials predate McKean materials. Dyck (1983) notes the lower numbers of McKean points in Saskatchewan compared to Duncan and Hanna materials, but McKean artifacts have been found in several components at sites within Wanuskewin Heritage Park, Saskatoon (see Ramsay 1993, Walker, Mack and Webster 1997).

The Pelican Lake complex is another poorly known entity within the province. The complex was first recognized at Mortlach, Saskatchewan in the mid-1950's (Wettlaufer 1955). Archaeologically, the Pelican Lake complex is renown for its triangular corner-notched projectile points that are often exquisitely made and frequently noted for their "Christmas tree" shape. Reeves (1978: 164-165, 171-172) has reported radiocarbon dated Pelican Lake levels at Head-Smashed-In Bison Jump in Alberta. Interestingly, this may be the first evidence that the site was used as a jump. Primarily a bison-hunting complex, Pelican Lake (3300-1850 rcybp Dyck 1983: 105 versus cal 4200-2100 BP: Morlan 1993: 39) appears toward the end of McKean/Duncan/Hanna complex and may represent an infusion into the area of a new people with new technology. Reeves (1983) and others (Wright 1995), however, support the idea that Pelican Lake developed out of the McKean complex. Brink (1988:109-135) notes strong similarities between Oxbow burial practices and Pelican Lake interments. However, because many of his criteria were based on potentially mixed materials from the Gray site, the picture is clouded somewhat but may still prove correct. Nevertheless, Brink clearly illustrates large differences between McKean burial practices and those of Pelican Lake suggesting that an evolutionary relationship does not exist there. Dyck and Morlan (1995: 537) feel that

Pelican Lake groups were responsible for the introduction of the bow and arrow onto the Northern Plains, although variation in point size suggests the possibility that the atlatl was also still in use (Dyck 1983: 105-107). Such an early introduction of the bow is not a idea popular with all archaeologists and many feel more comfortable with the idea that it was not introduced until about 1500 years ago (Frison 1991: 111). There has been some suggestion that Pelican Lake points, like Oxbow and Early Middle Period points, may have look-a-likes from later or earlier time frames that can potentially create a bimodal distribution of radiocarbon dates for the complex (Morlan 1993: 39, Dyck and Morlan 1995).

The next major cultural shift comes with the arrival of the Besant complex perhaps as long as 3,000 years ago (Morlan 1993: 39-40) although Frison (1991) and Dyck (1983) suggest that it is about 1000 years younger. Considering the fact that Besant people used pottery and probably the bow as well, the Besant complex should mark the beginning of the Late Precontact Period. The complex contains three identified projectile points types which overlap temporally but generally follow a sequence. This Besant point series includes Outlook Side-notched, Sandy Creek and Bratton points (Dyck and Morlan 1995: 537). Sites from this time period include many well-documented bison pounds and jumps, processing sites and habitation sites. In fact, many sources present Besant people as the ultimate bison hunters (Dyck 1983: 113; Frison 1991: 105).

As with Paleoindian assemblages, Knife River Flint for chipped stone tools is a common occurrence in Besant sites often at considerable distance from its source in North Dakota. Strong ties to North and South Dakota appear in many aspects of the northern Besant complex including the forms of pottery that appear at sites in Saskatchewan and the fact that Besant toolkits appear in burial mounds in the Dakotas (Dyck 1983: 1134-121). The pottery is the oldest on the Northwestern Plains. The Besant complex disappeared around 1100 years ago.

Avonlea complex assemblages may represent a group in competition for resources with Besant. The Avonlea complex has a temporal span of from 1900 to 900 calendar years BP (Morlan 1993: 40) therefore indicating that it was coeval with Besant. Diagnostics include thin, delicately-made triangular side-notched projectile points with straight or concave bases that were almost certainly arrowheads rather than to atlatl dart tips. Pottery vessels tend to be large and conoidal in shape with net-impressed, spiral-channeled or smoothed exterior finishes. Wettlaufer and Mayer-Oakes (1960) were the first to publish information on the Avonlea "Culture" based on samples excavated at Long Creek, Saskatchewan, but the projectile point type was first recovered in good dateable context at a bison drive and kill site at Avonlea Creek, Saskatchewan by Bruce McCorquodale and Albert Swanston in 1956 (Kehoe 1988: 7). In southwestern Saskatchewan rich components from mass bison kills at the Gull Lake site (Kehoe 1973) and the Estuary Bison Pound site (Adams 1977) have been attributed to this complex.

Toward the terminal date for the Avonlea complex, pottery becomes more prevalent and vessel shapes change toward shouldered globular forms. Projectile points once again change stylistically into what Dyck (1983: 126-139) has termed the Late Side-Notched Series containing variations of small points termed Prairie Side-Notched and Plains Side-notched. Prairie Side-Notched are crudely-made side-notched arrowheads which begin to appear around 1300 calendar years BP (Morlan 1993: 40). These small points were a very efficient use of raw lithic material and frequently appear to be minimally retouched flakes. Sometime around 700 years ago (Morlan 1993: 40) a more skillfully made arrowhead style known as the Plains Side-Notched point becomes prominent. Plains Side-Notched points are generally symmetrical with a characteristic straight-edged, box-like base created by notching the point deeply and relatively high up on the side margin, at right angles. A tremendous number of pottery types are associated with these point styles. Vessel shapes and surface treatments vary greatly from region to region. Occasionally, Plains Side-Notched Points are recovered in association with European trade goods.

3.3 Conclusion

In conclusion, bison-based economies were prominent in grassland environments of the Plains throughout all precontact periods, but numerous adaptive strategies must have existed at any one time and neighbouring groups probably had tremendous impact on one another. For example, grassland-adapted bison-hunting groups most likely felt the influences of their counterparts from woodland, desert or mountain areas, borrowing subsistence strategies when appropriate to exploit their own regional environment more effectively. Positive and negative interaction between precontact groups led to alliances and trading partners, as in modern societies, thus enabling the spread of innovation.

CHAPTER FOUR

HISTORICAL BACKGROUND AND RESEARCH METHODOLOGY

4.1 Initial Discovery and Museum Excavation

The Oxbow Dam site was discovered on May 24th, 1956 when avocational archaeologist Lieutenant H. R. Inglis noticed bison bones and lithic debris protruding from a hearth feature visible in the freshly eroded cutbank 120 yards down stream from the CPR dam on the Souris River near Oxbow, Saskatchewan. This measurement is according to Nero and McCorquodale (1958); however, the distance seems too far based on discussions with the landowner, who remembers the site location. The discoverer felt that the site was of considerable antiquity because the cultural material was almost three metres below the top of the bank. Lt. Inglis dug several small tests into the bank to assess the extent of the hearth.

That day, the lieutenant made a sketch of the cutbank that illustrated a potentially rich single component site containing a hearth feature and the remains of a relatively complete articulated bison skeleton (Figure 4.1). Also evident in the sketch is the fact that Lt. Inglis recognized the impact that floods had had on the terrace. Clearly, he knew that he had stumbled onto something of considerable significance and soon contacted the Saskatchewan Museum of Natural History (now the Royal Saskatchewan Museum) for guidance. Museum records indicate that he prepared sketches of the feature as well as some potential research questions regarding the nature of the site, several of which demonstrate a keen interest in site formation processes, precontact economics, trade patterns, and palaeoenvironmental reconstruction (Appendix B).

On June 1st, 1956 museum staff member Robert Nero visited the location and noted that the site appeared to be "deeply stratified" with cultural material visible 13 feet (approximately four meters) below the terrace surface and a bone and ash level (presumably Lt. Inglis' hearth) at a depth of 10 feet (approximately three meters) below surface (Nero 1956). Any further work at the site was viewed as a "conservation measure" (Nero 1956) because of the severe erosion that continued to threaten the remaining portion of the site.

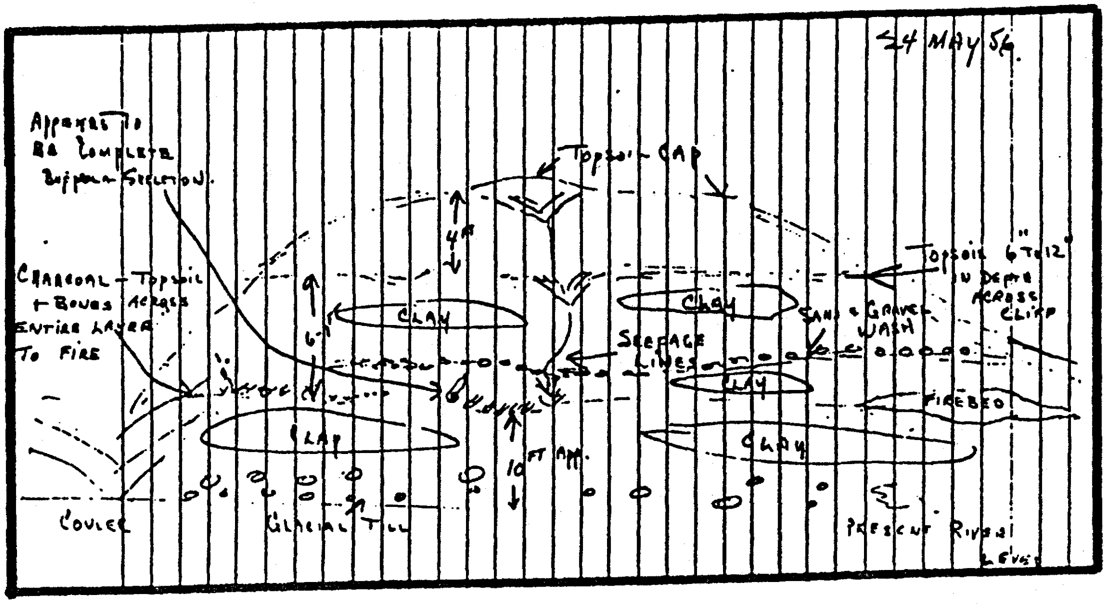


Figure 4.1: Lieutenant Inglis' sketch of the cutbank at DhMn-1 as it appeared May 24th, 1956. The later museum excavation appears to have been located near the area referred to as the "firebed." The firebed likely corresponds to the area that the Lieutenant tested on July 12th and 13th, 1956. Note the reference to a complete bison skeleton. (Courtesy of the Royal Saskatchewan Museum).

Lt. Inglis revisited the site on July 12th and 13th of the same year, and conducted further tests and reported his findings to the museum. On the 17th of July, SMNH staff members Robert Nero, Bruce McCorquodale, and Wolfram Niessen arrived at DhMn-1 and proceeded to spend several hours screening earth that had collapsed from the face of the cutbank as well as some back dirt from the hearth feature that Lt. Inglis and others had dug from the feature (Nero 1956, Nero and McCorquodale 1958). Their efforts paid off with the recovery of a Knife River Flint projectile point base which in hindsight is clearly not 'Oxbow' but was originally thought to be contemporaneous with the hearth feature (Nero 1956).

On July 18th, the staff chose what they thought was an appropriate spot to place a test pit in order to retrieve cultural material in good stratigraphic context from the hearth layer. After studying the exposed palaeosol in the cutbank, they decided to place the test pit in an area with minimal overburden which was also unfortunately rather severely slumped (see chapter seven Plates 7.2. - 7.5). A trench four feet by four feet by eight and one half feet was excavated directly into the cutbank face and the decision was made not to bother screening the majority of the overburden after initial efforts were unsuccessful. It seems that Nero was aware of several potentially productive palaeosols above the hearth level but time constraints prevented conducting a thorough investigation of them. Consequently, only the earth from 6 inches above the hearth level to three inches below it was screened. The hearth level was reportedly excavated using a trowel with "most of the artifacts being recovered *in situ*" (Nero 1956) and "in direct association with the hearth" (Nero and

McCorquodale 1958). An ash and charcoal sample from the feature was then submitted to the Saskatchewan Research Council's radiocarbon dating facility, yielding an age of S-44: cal 6289 [5947] 5655 BP (Morlan 1993). Unfortunately, no photographs or drawn planviews of the feature and its associated artifacts have been found in the museum archives. July 19th was spent mapping the entire area and sketching and photographing the test trench stratigraphic profiles as well as the eroded cutbank face. Later that day, the crew backfilled the trench and returned to Regina.

During the 1995 and 1996 field seasons the exact position of the original excavation could not be relocated. However, it soon became clear during the excavations that the stratigraphy at DhMn-1 was much more complex than had originally been reported. One of the factors noted was that the stratigraphy was very compressed at the south end of the new excavation block, to the extent that several levels appear to be a single thick dark band. This may have been the case in the location of the museum tests.

4.2 Historical Context of the 1956 Excavation

The following is a presentation of possible sources of error and sample contamination in the 1956 excavation. Any observations that are made are not intended as criticisms of the museum staff members who were, in fact building the framework for the cultural chronology still used throughout the Northern Plains. Many of the problems with DhMn-1 are evident only because of the forty or so years worth of archaeological work since the summer of 1956. Furthermore, several of the issues relate to technological problems of the day, while others relate to the extremely limited database at the time. Suffice it to say that the SMNH excavation and report was completed by very competent individuals but that circumstances such as time constraints, compressed strata, and the total lack of comparative data may have led to various problems.

It is important to understand the backdrop against which the 1956 Oxbow Dam site excavation occurred in order to fully comprehend what happened and why. An excellent review of the Saskatchewan Museum of Natural History's involvement in archaeology is Ian Dyck's "Eighty-one Years of Archaeology in the Saskatchewan Museum of Natural History" published in 1987. What follows is a synopsis of the pertinent points. The 1950s were a time of immense change at the SMNH. The museum had existed in various forms for fifty years by the time staff members conducted work at DhMn-1. Several skillful and conscientious avocational archaeologists were active in the province at that time many of whom had large artifact collections worthy of display. Misunderstandings between the avocationals and the museum administration led to feelings of resentment toward a government institution that would lay claim to information generated through private research. Influential collectors tried to push the museum toward hiring a full-time professional archaeologist to conduct research in the discipline rather than continually having their own collections and efforts exploited by the institution. It seems, however, that the budget for such a position did not exist and it was only through joint sponsorship by the provincial government and the National Museum of Canada that a summer assistantship could be sustained during this time of expansion. From an archaeological standpoint, the most noteworthy of the summer assistants was a former resident of the province named Boyd Wettlaufer who was enrolled in graduate studies in archaeology at the University of New Mexico (Dyck 1987: 20).

Wettlaufer's accomplishments over the course of several summers between 1951 and 1954 are truly remarkable. In his first season, he conducted a survey of private collections and known archaeological sites and began subsurface tests at a number of archaeological sites to assess their research potential. Wettlaufer also outlined the direction that the Museum should take regarding archaeological resources in the province. His recommendations suggested that various salvage projects should be undertaken at the Lake Midden and other sites and that major excavations at multi-component sites like Mortlach and Gull Lake should commence shortly thereafter (Dyck 1987: 21).

Throughout the early to mid 1950s, then, public awareness towards archaeology was increasing largely due to the extraordinary efforts of collectors like Alan Hudson from the Mortlach area and pioneering professionals like Boyd Wettlaufer representing the National Museum of Canada and the Saskatchewan Museum of Natural History. Around this time, plans were being formalized for the construction of a new museum facility to be built in time for Saskatchewan's Golden Jubilee in 1955 (Dyck 1987: 20). The museum was actively collecting artifacts to embellish its existing collections for displays in the proposed new building. Large scale excavation was too costly so smaller scale surveys of collections and minimal site reconnaissance were seen as more practical and cost effective methods to maintain public support and retrieve valuable information. At the same time, problems were arising over where responsibility for the protection of heritage resources should be placed. The museum administration was in favour of developing an archaeology program but ultimately felt that responsibility for provincial archaeology should not be their concern.

The establishment of the first radiocarbon dating facility in the British Commonwealth occurred in late 1953 at the Saskatchewan Research Council in Saskatoon (Wettlaufer 1955: 71). To the public, this rather momentous occasion changed the face of provincial archaeology from a worthwhile hobby to a science as absolute dates could be determined for artifact bearing deposits with a reasonable degree of certainty. The first archaeological use of the facility was the dating of deposits excavated at Mortlach in 1954. The multi-component Mortlach site, with 'atomically' dated stratigraphy was the beginning of large scientific excavations in the province. The Wettlaufer (1955) publication on the site must have impressed both the public, who were flocking to the new museum, and archaeologists throughout the Plains for whom the site has left an indelible impression because of its stratified sequence of Late Precontact components. The idea that Saskatchewan could be a leader in this field during its jubilee year undoubtedly fueled support for further archaeological exploration. It is most unfortunate that following the release of his publication, Wettlaufer left the province to pursue interests elsewhere only to return when called upon, eventually giving up hope of a full-time position as provincial archaeologist in 1959 (Dyck 1987: 25).

Also during 1955, the museum hired Dr. Robert Nero as an assistant director. Nero soon became an asset with his considerable skills in zoology and, most particularly, public relations (Dyck 1987: 23). Nero's abilities complemented those of Bruce McCorquodale, who had been hired several years earlier as a curator with a background in palaeontology and geology. Though neither was a trained archaeologist, Nero and McCorquodale conducted archaeological projects throughout the province during the mid to late fifties, one of which was the testing of DhMn-1.

It seems likely from Nero's in-house report on the excavations at DhMn-1 that a hidden agenda for the scaled-down archaeological program which the museum had implemented was to identify sites with high research potential, publicize their findings and hope that large-scale projects would occur at the localities with museum finances and human resources playing a minor role. The following quote clearly illustrates this point:

> It is recommended that a preliminary report be made as soon as possible, to be submitted to competent archaeologists outside of the province (there being none within) in order to bring this information to those who are more competent to judge the archaeological value of the site and who are in a position to conduct further excavation if warranted. (Nero 1956)

There can be little doubt that Nero expected an outside institution to take on the responsibility for conducting further work at the site particularly when one considers that the radiocarbon samples established the Oxbow Dam site hearth feature as the oldest dated *in situ* cultural deposit in Canada. Therefore, though it was important in its own right, the brief article published in *Blue Jay* (Nero and McCorquodale 1958) failed to lure the appropriate parties. Perhaps the completeness of the report led others to assume that all potential work at the site was finished. The call for more work at the site was also expressed by others (see Wettlaufer 1960b: 100).

4.3 Oxbow Levels at Long Creek

One year after museum staff had recovered artifacts at the Oxbow Dam site, a large-scale excavation on Long Creek (Wettlaufer and Mayer-Oakes 1960) took place which resulted in the recovery of stratified cultural material spanning the past 5000 years. The project was a salvage operation designed to recover as much information as possible from a series of sites that would be flooded with the construction of Boundary Dam. Following an archaeological survey of the prospective reservoir, a number of sites were identified, but costs and time factors limited the excavation to only one site. The Long Creek site (DgMr-1) is located approximately 60 km west of DhMn-1 on a tributary of the Souris River from which it gets its name.

The project was not without its difficulties. The principal investigator, Dr. William Mayer-Oakes, was replaced part way into the excavation because of previous obligations. Boyd Wettlaufer returned to Saskatchewan to assume the duties of field researcher in charge of the excavations and later, the artifact analysis (Dyck 1987: 24). Much of the work was conducted under tents as weather conditions had turned cold and the first snow had already fallen. Furthermore, time constraints forced the excavators to use heavy equipment to remove material in order to assess the lowest cultural levels. During the excavation, Wettlaufer and his crew identified nine distinct cultural levels which seemed continuous between two large block excavations, separated by about 45 meters, on a terrace. Between the blocks was a spring. Originally, levels seven and eight were assigned to the Oxbow culture (Wettlaufer 1960a and b) but by 1981, Wettlaufer (1981: 81) had proposed that levels five six, and nine all be considered as Oxbow components.

Level seven contained a variety of lithic artifacts including two basally-concave, side-notched projectile points, a large hafted biface, an "ovoid blade", and two possible bone tools, as well as a variety of biface and uniface fragments (Plate 4.1). Charcoal from this level produced an age of S-50: 4620 +/- 150 rcybp (McCallum and Wittenberg 1962: 75). Morlan (1993) has since calibrated this date to S-50: cal 5720 [5317] 4869 BP. Level eight produced a similar date of S-52: 4620+/-80 and S-53: 4650+/-150 rcybp (McCallum and Wittenberg 1962: 75) and, again, these dates have been calibrated and averaged to S-52 and S-53: cal 5567 [5319] 5054 BP (Morlan 1993). The level contained a relatively large artifact assemblage which included numerous examples of basally-*thinned*, side-notched projectile points that were assigned to the newly defined Oxbow culture (Plate 4.2). The word 'thinned' has been emphasized here to differentiate these points from the basally-notched or basally concave, side-notched points that are commonly recognized as "classic" Oxbow (Reeves 1973: 1245). The projectile points from this level may not be representative of the Oxbow complex but may instead be of an earlier or even contemporary related complex of the Mummy Cave series. This idea has been previously mentioned by Reeves (1973), Meyer (1981) and Quigg (1984). Reeves (1973: 1245) suggests that the points could easily fall into Bitterroot and Salmon River side-notched types. In fact, Mayer-Oakes (1960a: 116) had originally proposed that this variety be

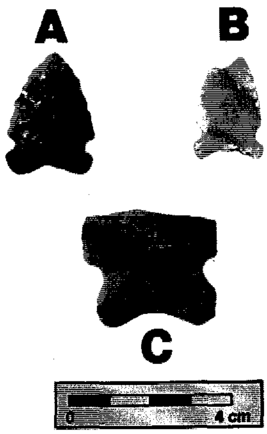


Plate 4.1: Photograph depicting selected lithic tools from level seven (Oxbow) at the Long Creek site (DgMr-1). A: fused shale Oxbow projectile point, B: chalcedony Oxbow projectile point, C: fused shale hafted biface similar to example from DhMn-1 (see chapter six, Plate 6.3).

referred to as "Long Creek Side-Notched" rather than Oxbow. Wettlaufer (1960a: 111) thought that such old side-notched points could potentially be related to Logan Creek material from Nebraska but discounted the idea because he was unable to inspect the Logan Creek points for confirmation and those assemblages included notched scrapers whereas the Saskatchewan material did not. In retrospect, then, it appears that levels six and seven fit within the Oxbow complex while level eight does not.

4.4 1995 University of Saskatchewan Field Methods and Procedures

Nero and McCorquodale's pleas for continued research were finally answered when fieldwork resumed at DhMn-1 in August of 1995 after a 39 year hiatus. Work began with a one day trip to Oxbow Dam to meet with the landowner, inspect the cutbank for features and artifacts that may have been eroding out and to get some idea of the overall condition of the remaining portion of the site. Subsurface testing began after attaining the appropriate permit (Type-A Research 95-104) from the Heritage Branch of the Government of Saskatchewan. The east bank of the Souris River was, once again, visually inspected for artifacts and/or features for approximately 150 metres south of the dam. The entire cutbank immediately downstream from the dam had been covered in a one meter-deep layer of fist-sized

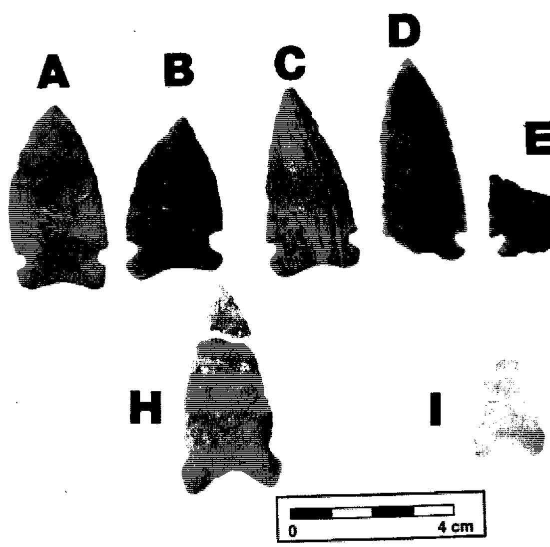


Plate 4.2: Projectile points from level eight at the Long Creek site (DgMr-1: top row) and the Oxbow Dam site (DhMn-1: bottom row). Top Row: A, B, C: basally-thinned, side-notched fused shale projectile points (Mummy Cave series?), D: KRF projectile point (entire basal margin is broken off), E: fused shale straight-based, corner-notched point (Mummy Cave series?), F: fused shale basally-concave, unnotched projectile point (Oxbow preform?), G: small, straight-based side-notched projectile point (compare to Plate 7.6: A), Bottom Row: H: SRC Oxbow projectile point from DhMn-1 level six, I: Swan River Chert Oxbow projectile point from DhMn-1 level six (Note deeply concave bases on both specimens).

cobbles to minimize the effects of erosion during spring floods on the road atop the bank. The cobbles had been placed on the site only after a severe flood in the mid-1960s had washed out a large portion of the terrace where the artifacts lay buried. Having removed the layer of cobbles from part of the cutbank by hand, testing began by excavating two adjoining one-by-one meter units running north-south overtop of an area where flakes and debris could be seen eroding out of the bank. Both units which made up the trench were excavated in five centimeter arbitrary levels by quadrant using trowels for greater control. All of the artifacts encountered during the excavation were mapped using three point provenience. The backdirt was then screened through six mm mesh to aid in data recovery.

A third trip to the site lasted six days and commenced September 5th, 1995. Two crew members continued digging in the test units, while three others conducted a topographic survey of the site surroundings. The units were excavated to a level 10 centimeter below a prolific Oxbow complex level and the cutbank beneath it was cleaned back another meter down to look for visible signs of more palaeosols in the fine silty-sand matrix. A very faint, poorly developed soil horizon was detected just below the Oxbow level at that time but was not investigated further until 1996. A 50 centimeter by 50 centimeter test unit was also placed on a remaining portion of the cutbank approximately 45 meters south of the other two units. This small test unit indicated that the soils and stratigraphy varied somewhat across the terrace but that the well developed palaeosols were generally continuous with those in the larger test area.

The survey project was done to create a high resolution topographic map of the site area. Significant changes in the landform over the last forty years warranted the creation of a new map. All of the survey data was processed using an IBM computer by Michael Magee who generated the map which appears in this volume (see chapter two Figure 2.1). The success of the mapping project has aided greatly in interpreting the original manuscript as comparisons between the two maps are much easier than attempting to interpret estimates of distances using the map from the original publication which contained no scale and few visible landmarks.

4.5 Site Condition

The landform has been altered a great deal over the last four decades and many of the distance measurements which appear in the *The Blue Jay* (Nero and McCorquodale 1958) are inaccurate making it virtually impossible to relocate the exact position of the early excavation. To complicate things more, the dam from which distance estimates were given was replaced with a new dam in the 1960s, several meters downstream from the original. Comparison of air photos from 1948 to recent air photos indicates that a significant amount of earth was removed from the surface of the terrace during road expansion in the 1960s. The improvements to an existing cart track were done during pipeline installation. The pipeline and the road to the ford have destroyed a portion of the site and isolated a small patch of undisturbed terrace about 45 meters south of the main test area.

4.6 1996 University of Saskatchewan Field Methods and Procedures

The 1996 component of the research was carried out between August 10th, and September 15th. In total, 141 person days were spent in the field. The systematic excavation of 16 complete one meter by one meter units as well as seven narrow one meter by 50 centimeter units in a large block (Plate 4.3) commenced on August 11th, 1996. The entire row of units along the 28 meter east of datum line were located along the face of the cutbank. The block excavation incorporated the two units excavated the previous year. The block itself, was oriented along the cutbank with an imaginary datum 96 meters south and 28 meters west of the southwestern corner. A backhoe was used to remove the meter-deep layer of cobbles that had been dumped on the bank to protect it against the severe erosion which had already destroyed large portions of the site in the 1950s, 1960s and 1970s.

Plate 4.3: Photograph looking east toward completed excavation block September 14th, 1996. Note downward slope in strata toward the south.

An unanticipated event occurred while monitoring the backhoe work when the operator uncovered two palaeosols above any that were excavated the previous year. The bank had eroded in a stepped fashion leaving upper components intact further back into the bank. Time constraints necessitated the use of shovel shaving to excavate the upper levels quickly in order to get to the more productive lower levels. However, any levels that yielded visible features or artifact concentrations were trowelled and all features and artifacts were mapped using three point provenience. Units were excavated using a combination of natural and arbitrary levels. Arbitrary five centimeter levels were used as a control mechanism in case natural levels could not be detected. Once changes in natural stratigraphy were noted, the contour of the level was 'followed' until a lower limit was distinguished or to a thickness of five centimeters, whichever came first. All units were excavated by quadrant. Of course, all of the loose matrix was screened through six millimeter mesh or water screened through two millimeter mesh. Fine-screen samples were collected from features such as hearths and flaking stations. For palaeoenvironmental reconstruction, all of the soil from the northeast quadrant of one unit was retained to be water screened. Some water screening was conducted at Oxbow to reduce the bulk of the soil to be transported back to Saskatoon. One deep test probe was excavated to a depth of approximately 3.8 meters below the datum to see if older cultural levels existed. Finally, a test trench from 1995, located approximately 45 meters south of the main block, was extended in length and depth, using the excavation techniques described above, to see if soil profiles matched in both locations and to see if any significant cultural deposits existed south of the main block.

4.7 Laboratory Analysis and Procedures

Artifact processing and laboratory analysis was conducted at University of Saskatchewan facilities on campus and at the laboratory at Wanuskewin Heritage Park. Fine-screen samples were water screened and sorted into lithics, faunal and floral remains by the author and several student volunteers. Volunteers helped in washing and sorting all of the artifacts in the assemblages. Once washed and sorted, artifacts were identified, counted, weighed and catalogued using the MacAdem 10.6.1 data entry and management program (Gibson 1991) and a Macintosh color classic computer. The program allows the user to record information on lithic materials including tool types, various forms of modification, raw lithic material type as well as provenience. Similarly, it allows for the identification of floral and faunal material to varying taxonomic levels, element, side and cultural and natural modifications. For a full prospectus on the MacAdem program see Gibson (1991).

Identifiable faunal material was positively identified using the University of Saskatchewan Department of Anthropology and Archaeology's faunal collection. Similarly, the identification of lithic materials was confirmed using the department lithic collection. One exception was a sidescraper and flake made from Antelope Chert. The material is exotic to the province with a source area in MacKenzie County, North Dakota. The material was identified by Stan Ahler (pers. com. 1995) and later confirmed using Beckes *et al.* (1987). The metric analysis of faunal and lithic materials was completed by the author to maintain consistency.

CHAPTER FIVE

SITE STRATIGRAPHY, RADIOCARBON DATES, AND PALAEOENVIRONMENT

5.1 Soils

The soils in and around the Oxbow Dam site area are referred to as Dark Brown and Black Chernozemic soils characteristic of semi-arid mixed prairie and sub-humid fescue prairie (Moss and Clayton 1969: 69-72). Their dark colour is due to a relatively high level of decaying organic material within the matrix resulting from high regional humidity. The buried soils represented in the profile of the alluvial terrace at DhMn-1 show considerable variation. This variation is due to several factors including the amount of time the soil had to develop, the climate at the time of development, amount and type of vegetation, topography, drainage capabilities, and the type of parent material from which the soil developed (Moss and Clayton 1969: 72). Moss and Clayton (1969: 72) also add human involvement in the process of soil development. Soils that have been intentionally or unintentionally altered significantly by human activities are referred to as anthrosol soils (Eidt 1984: 23). Any number of human activities unintentionally alter soils within a specific location including things like butchering practices or the creation of middens where various nutrients derived from decomposing animal carcasses and plant material are added to the soil much like the intentional practice of composting. Plant gathering activities which involve the transportation of items such as berries from a collection location to a base camp can introduce these species to new areas, thus affecting the range of vegetation which ultimately affects soil development. The amount of debris evident in cultural levels five and six suggests that human activities involving food processing played a significant role in the development of the associated soils.

5.2 Introduction to Site Stratigraphy

Research into geological evidence for climatic change in North America reached a milestone in 1955 with the publication of an influential paper entitled "Geologic-climatic dating in the West" by Ernst Antevs (1955: 317-335). Within the paper, Antevs proposed that evidence of a prolonged period of drought lasting from approximately 7500 years ago to 4000 years ago could be detected in the western United States by the study of geomorphology in combination with archaeology. Antevs referred to the period as the Altithermal Long Drought. Recent studies on lake sediments, sphagnum peat development, and alluvial terrace development, which will be discussed further in section 5.6 (this chapter), indicate that the temporal span of the Altithermal varied considerably from location to location. Across the Plains, archaeologists noted a scarcity of archaeological deposits associated with this time period. Some suggested that total human abandonment may have occurred (Mulloy 1958), while others felt that human occupation was simply limited to areas of higher altitude or along major water courses where the effects of increased temperature and aridity were less severe (Hurt 1966). Reeves (1973: 1243) suggested that human occupation continued but that geomorphological processes associated with increased aridity destabilized landforms and contributed to the erosion or deep burial of earlier archaeological deposits located on river terraces and flood plains. Mandel (1995: 60) concludes that this appears to be the case for middle Holocene archaeological sites in the Central Plains. Similarly, Artz (1995: 83) notes for the northeastern Plains that shallowly buried sites (read: easily detectable sites) dating to the early and middle Holocene are likely to be found on small, less active tributaries (e.g., Long Creek), rather than in major river valleys. Reeves (1973) suggested that as climatic conditions began to ameliorate, at around 5000 years ago, landforms began to stabilize and soils began to develop. Therefore, post-5000 year old strata should contain relatively well-developed palaeosols while soil development should be poor from about 7500 BP to 5000 BP. Consequently, the majority of Northern Plains river terrace archaeological sites are younger than 5000 years. Reeves (1973) speculated that any sites dating to the earlier portion of the Altithermal would exist on poorly developed horizons, characteristic of arid unstable conditions, if they could be detected at all. He also suggested that this was why there were no well developed palaeosols and archaeological deposits from DhMn-1 older than 5200 BP or from DgMr-1 older than 5000 BP. In retrospect, the dates from DhMn-1 and DgMr-1 may be problematic (see chapter seven) but Reeves' point is certainly valid and the results of the 1995-1996 excavations at the Oxbow Dam site indicate that only very poorly developed soils are evident beneath the Oxbow complex occupation.

The stratigraphy at DhMn-1 is typical of deposits on alluvial terraces. Many alternating bands of light and dark strata indicate that the terrace experienced periods of stability when soils developed (dark bands) while lighter bands generally correspond to the introduction of new sediment to the landform from flood episodes and aeolian and colluvial deposition. For example, following the mass deposition of alluvium, the former soil surface ceases to develop. New soils then develop from the new alluvial parent material until further deposition of alluvium, colluvium and/or loess occurs (Moss 1978: 4-23). Consequently, areas with relatively rapid alluviation often have flood plains and low terraces characterized by poorly developed soils simply because the soils do not have time to mature. Knox (1987: 157) notes that high energy catastrophic floods have a signature pattern evident in stratigraphic profiles characterized by intense erosion, transportation, and deposition of alluvium. Such profiles often contain truncated buried soil horizons, indicative of the early erosional stage of a major flood, overlain with poorly sorted, laminated alluvium. This alluvium may be considerably different in texture and colour from the underlying remnant soil. This is precisely the pattern associated with several of the strata at DhMn-1 (Plate 5.1).

It should be noted that the stratigraphy at DhMn-1 fits closely the stratigraphy described by McFaul (1990) for synchronous abandoned floodplain terraces along the Souris River in nearby Renville County, North Dakota. McFaul (1990: 37) suggests that a series of alluvial steps or terraces, which he refers to collectively as "HT3," did not become available for human occupation until approximately 4,000 to 3500 BP because mild, but periodic, flooding between 5000 and 4000 BP would have limited the opportunities for occupation. He notes the presence of as many as seven buried 'A' horizons at specific HT3 locations along the Souris River. Beneath these relatively well developed buried soils characteristic of mesic conditions are thick bands of sand which he postulates were deposited by aeolian and colluvial mechanisms during the Altithermal, based on regional palaeoclimatic reconstructions by Clayton *et al.* (1976), Hamilton (1967), and Boettger (1986) (all as cited by McFaul 1990: 34).

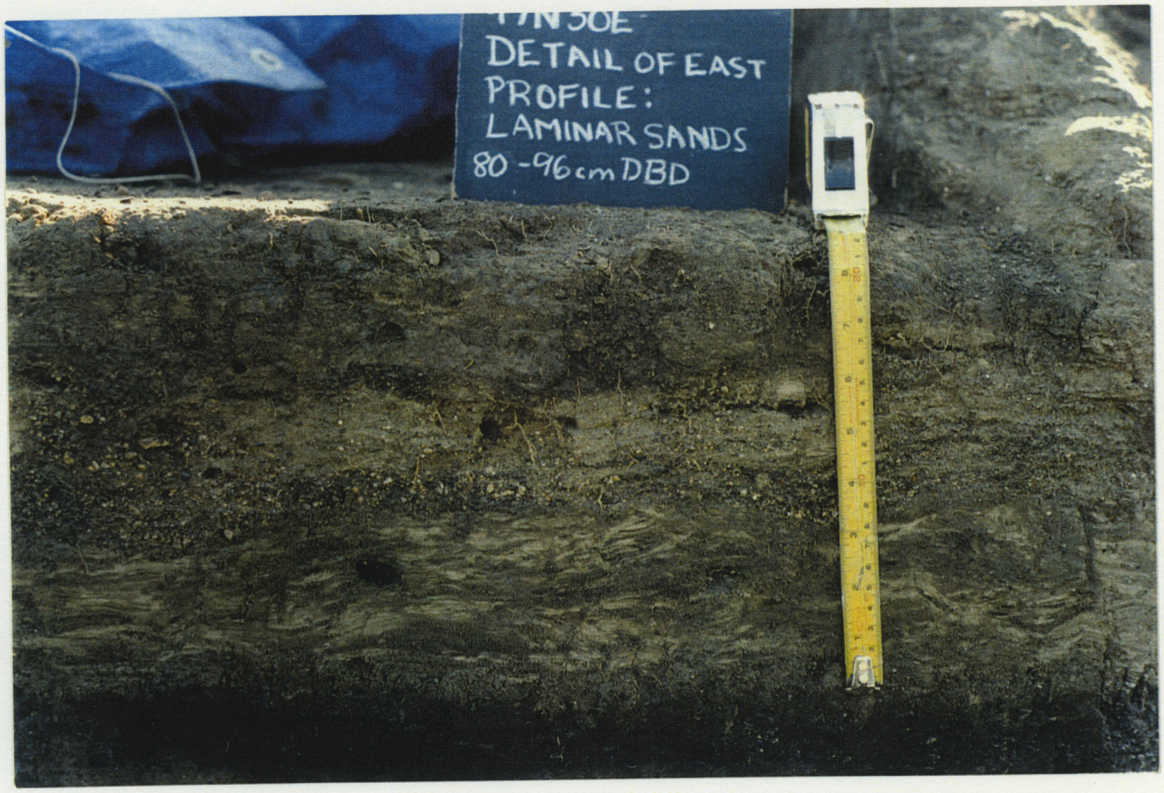
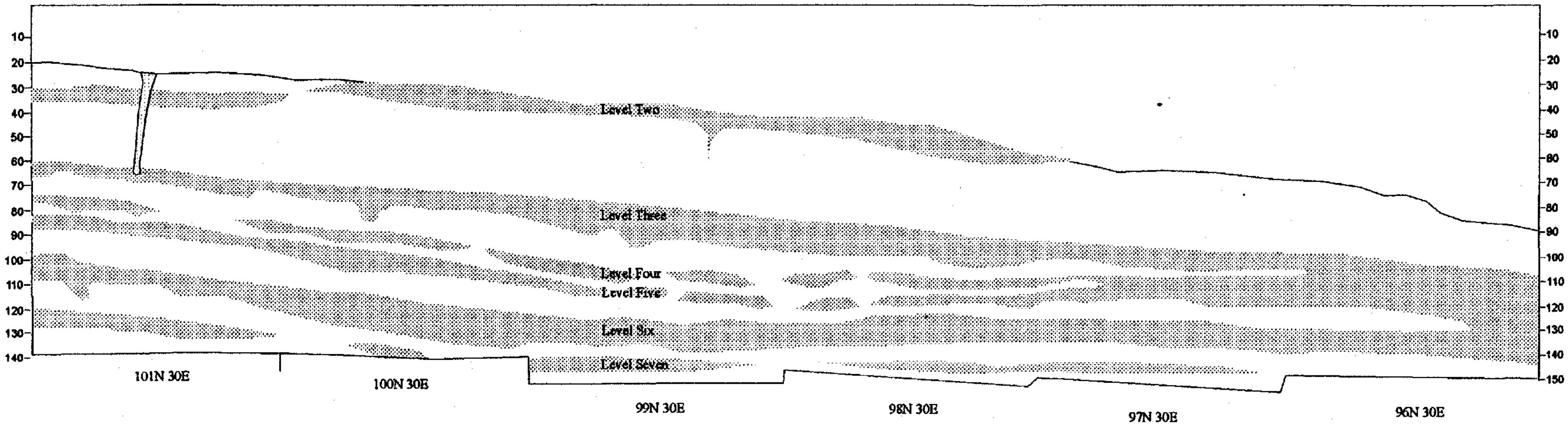


Plate 5.1: Close-up of alluvial laminar sand and silt deposits characteristic of severe floods above cultural level three at DhMn-1.

In order to maintain numeric continuity between cultural levels and natural strata, the analysis of the site stratigraphy is presented in reverse chronological order beginning with the most recent geomorphic developments and working backwards toward the earliest developments. The palaeosols are presented in reference to the artifact assemblages with which they are associated. Many of the palaeosols show signs of rapid soil depletion likely due to flooding. These palaeosols often appear as truncated dark horizons demarcated by an abrupt colour change at their upper limits, topped with much lighter coloured sediments which differ significantly in texture. The overlying alluvial sediments may exhibit laminar beds of sand and fine gravel referred to as the bed load, characteristic of high energy floods (Plate 5.1). The stratigraphy at DhMn-1 slopes downward from North to South and from East to West (Figure 5.1). Most levels show a downward slope of up to 60 centimeter over an eight meter span from the north end of the excavation to the south end (see chapter four Plate 4.3). Therefore, descriptions of cultural and sterile levels in reference to depths below datum are impractical as the depths change considerably from unit to unit. Furthermore, the sequence becomes compressed toward the south end of the excavation block where cultural levels four and five become difficult to distinguish visually. Artifacts from these levels were separated by the presence of sections of sterile matrix within the compressed strata, however, some mixing may have occurred. At the north end of the excavation, cultural levels three through six inclusive are contained within a 70 centimeter span, while at the south end, they are contained within a 45 centimeter span. For more information regarding depths below datum for strata in specific units, refer to the stratigraphic profiles illustrated in figure 5.1.

The matrix analysis was completed in the field by the author using rudimentary soil texture field test techniques including ribbon tests and taste tests to assess sand, silt and clay contents. In other words, sediment texture was determined by 'chewing' the matrix to test for grittiness and by rolling the matrix into ribbons to test for silt and clay ratios.



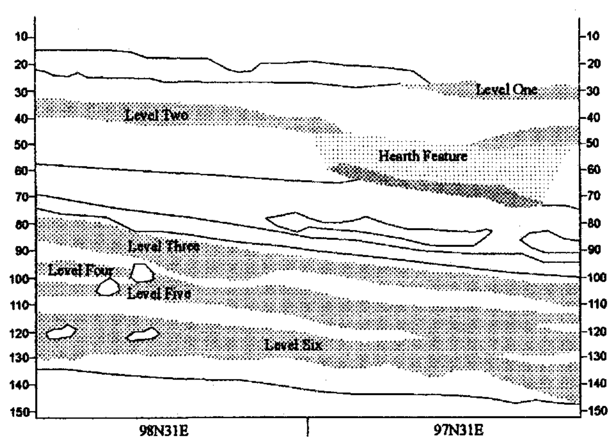


Figure 5.1: Stratigraphic profile of east wall of units along the 30 meter east grid line (above) and along the 31 meter east gridline (left). Note the downward slope of the in strata from north to south.
Level One: grey/brown clayey~silt.
Level Two: dark grey/brown silty~loam with hearth feature
Level Three: very dark grey/brown silty~loam.
Level Four: very dark black silty~loam.
Level Five: very dark black silty~loam.
Level Six: black clayey~silt.
Level Seven: light grey/brown clayey~loam Regosol.

5.3 Site Stratigraphy

5.3.1 Cultural Level One

The palaeosol associated with cultural level one is overlain with a light yellow/brown sand and silt deposit which is the uppermost intact stratum at the site (Figure 5.1). The ground surface was intentionally armored with a layer of fist-sized cobbles approximately one meter thick sometime within the last four decades to combat the effects of alluvial erosion. Cultural level one is associated with a weakly developed medium grey/brown buried 'A' horizon usually less than two centimeters thick. The palaeosol has a high clay~silt content. In some areas, this horizon has been completely removed and partially stripped in others due to subsequent floods. Directly beneath the cultural level one 'A' level is a light brown silty 'C' horizon. The fine particles that make up this segment of the soil profile may have been deposited during a relatively low energy episode of flooding as waters slowed and fine particles fell out of suspension, or through aeolian deposition.

5.3.2 Cultural Level Two:

Cultural level two corresponds to a dark grey/brown silty 'A' horizon which ranges in thickness from five to ten centimeters (Figure 5.1). A small hearth pit feature cuts through a clayey silt 'B' horizon terminating at the top of the light brown 'C' horizon. In profile, this feature appears as an ashy deposit with a red oxidized lower boundary (Figure 5.1). The associated medium grey/brown clayey silt 'B' horizon has a very undulating lower boundary ranging in thickness from approximately 10 to 15 centimeters.

The 'C' horizon appears as a series of very light brown poorly sorted gravels and sands atop cross-laminated, sands and silts approximately 15 to 20 centimeters thick. Stratigraphically, the bottom of the sequence begins with cross-laminated sandy silts followed by middle sections of poorly sorted sands and gravels with lower percentages of silts and clays followed in turn by upper sections with higher percentages of silts and clays (Plate 5.1). The middle portion containing poorly sorted sand and gravel with particles larger than two millimeters appears as a lens-shaped deposit very similar in description to what Knox (1987: 158) refers to as overbank deposits resulting from a severe flood. This type of sequence has been recognized in deposits along the Mississippi Valley and has been attributed to large scale floods (Knox 1987:155). Cross-bedded sands and gravels of this nature have been referred to as the traction carpet or channel bed load by Selley (1982:179-181). The planar nature of the base of this deposit suggests that the flow of the river during the initial flood stage was relatively rapid (Selley 1982: 177-194) and that all of the parent material was left during a single catastrophic flood (Ponomorenko pers. com.).

5.3.3 *Cultural Level Three*

A thin but distinct dark grey/brown silty loam exists above cultural level three. The dark band appears to be in direct contact with the underlying light brown clayey silt 'C' horizon that suggests that this may be a soil that had very little developmental time before it was buried or, it may represent some form of redeposition. The entire horizon has been completely eroded away in the southwest portion of the excavation block.

The palaeosol associated with cultural level three is a moderately well developed silty loam 'A' horizon which has been degraded in some areas but appears as a black band up to eight centimeters thick toward the north end of the excavation (Figure 5.1). A medium grey/brown sandy silt 'B' horizon is visible beneath the 'A' horizon in most areas but has also been partially eroded away in the northwest portion of the site where the 'A' level is completely gone. The parent material is a medium brown sandy silt up to approximately 10 centimeters thick.

5.3.4 Cultural Level Four

As mentioned above, the stratigraphy at DhMn-1 is generally well separated at the north end of the excavation but becomes very compressed and increasingly difficult to separate toward the south end (Figure 5.1). This phenomenon has affected cultural levels four and five to such an extent that the levels appear as a single soil unit at the south end of the excavation but as two distinct levels at the north end. Because separation of the soil levels toward the south end is extremely difficult due to compression, some mixing of artifacts may have occurred. The palaeosol associated with cultural level four is a very dark black silty loam 'A' horizon up to 12 centimeters thick at the north end of the block. Level four is readily distinguishable from cultural level five in the northwest portion of the site where the two dark black levels are separated by a medium grey sandy loam lens up to five centimeters thick. Numerous artifacts, including scrapers and a broken projectile point, were recovered from this level.

5.3.5 Cultural Level Five

Cultural level five is associated with a thick, very dark black buried 'A' horizon (Figure 5.1). The 'A' horizon is an undulating silty loam ranging from approximately five to 12 centimeters in thickness containing occasional fist-sized cobbles, flakes, bone fragments and charcoal visible in the profile. Artifacts from this level have been assigned to the McKean/Duncan/Hanna complex based on a fragment of a projectile point base recovered from unit 96N 30E. This projectile point base is stylistically similar to Hanna materials recovered from the Long Creek site (Wettlaufer and Mayer-Oakes 1960: 50) from a level radiocarbon dated at two sigma to S-63a cal: 3989 [3630] 3278 BP (Morlan 1993) suggesting that this horizon is of a similar age. A distinct 'B' horizon is visible in some areas of the site as a dark grey/brown silty loam but is less discernible in other areas. The 'C' horizon parent material is medium brown silty loam.

5.3.6 Cultural Level Six

Cultural level six is associated with a black clayey silt 'A' horizon which has been truncated by erosion (Figure 5.1). In certain areas of the site, this horizon has been completely removed by floods, while in other areas it is visible in the profile as a thick black band containing charcoal, bone fragments, fire cracked rock, and lithic debitage. The 'A' horizon is up to 15 centimeters thick in certain areas. Oxbow complex cultural material associated with this level suggests that a stable ground surface existed on the terrace around 4500 to 4000 years ago. A medium grey/brown clayey silt 'B' horizon ranging from three to eight centimeters thick is discernible beneath the 'A' level. The 'C' horizon appears as a light brown clayey silt with evidence of calcium carbonate leaching. This horizon is of variable thickness ranging from approximately 10 centimeters to less than five centimeters.

5.3.7 Cultural Level Seven

This is referred to as a cultural level although contextual information regarding the lithic artifacts associated with it is weak. The 'A' horizon appears as a poorly developed faint light grey/ brown Regosol which is less than five centimeters below the Oxbow 'A' horizon in places (Figure 5.1). A radiocarbon date on bone collagen suggests that the surface was stabilized for brief episode between 7500 and 8000 BP (see Section 5.5, this chapter). Beneath this Regosol is a thick band of light yellow brown silty sand.

Any evidence of buried soils beneath this level appears as thin bands of humic 'A' horizons always less than five centimeters thick separated by substantial deposits of light brown sandy~silt. Two examples of this form of Regosol were noted in a deep test hole placed in unit 99N 28E. Level eight is visible at 215 centimeters below the datum and level nine is visible at 255 centimeters below the datum. It should be noted that a thinning flake and a small piece of bone exhibiting cutmarks were recovered from a light brown clayey~silt level approximately 270 centimeters below the datum. These items were not associated with any visible palaeosol, however, they were located in close proximity to a small burrow.

5.4 Bioturbation

The stratigraphy at DhMn-1 shows evidence of various forms of disturbances including bioturbation. One form of bioturbation involves the excavation of earth by burrowing animals in order to create living spaces or dens. An example of this was a filled-in animal burrow encountered in unit 102N 28E. The feature was originally presumed to be a mink's den (*Mustela vison*) based on it's size and the presence of a considerable number of frog and fish bones within it. However, according to Banfield (1987: 329-332), a mink den should contain a high percentage of small mammal remains such as voles and mice, slightly lower percentages of fish and amphibian remains and possibly bird remains. It seems likely that the feature was a Belted Kingfisher's (*Ceryle alcyon*) tunnel (Morlan pers. com.), based on the feature's shape and contents. Its narrow entrance led to a large cavern filled with thousands of bones belonging to fish and frogs mixed with decaying seeds and fine grass-like material. The dietary remains closely match as does the description provided by Godfrey (1986: 341-342) for a Kingfisher's tunnel which expands into a circular cavern.

A large rodent burrow was encountered in unit 98N 29E, level seven. This unit also produced bison bone used for radiocarbon dating as described below. Planview drawings and field notes indicate that culturally modified bone and lithic material recovered from this level and unit was found within the rodent burrow or in the screen and, therefore, it may not be associated with the radiocarbon date for the level.

A small piece of butchered bone and a fused shale thinning flake recovered from a depth of approximately 270 centimeters below the datum may have been redeposited by bioturbation. There is no visible palaeosol at this level, however, a narrow burrow which contained bison rib fragments was noted at approximately the same level.

5.5 1996 Radiocarbon Dates

Morlan (1993) recently published a compilation and assessment of radiocarbon dates from Saskatchewan. Stressed heavily in the article is the importance of careful sample selection to ensure the sample is actually associated with the target event. Also stressed is the establishment of minimal requirements for reporting radiocarbon dates. Throughout this document, every attempt has been made to present as much information as possible on dates that are discussed. Here, Morlan's protocol is used presenting laboratory specimen numbers followed by the resultant age with a standard deviation and the abbreviation rcybp (radiocarbon years before present) to refer to raw laboratory dates, that is, uncalibrated, and non-normalized. Conversely, normalized and calibrated dates are reported as laboratory specimen number: "cal" maximum age at two sigma, maximum age at one sigma [calibration curve intercept point] minimum age at one sigma, minimum age at two sigma in accordance with the CALIB program by Stuiver and Reimer (1986). The dates are reported at two sigma to ensure a 95.4% probability that the true age of the specimen falls within the reported range.

Normalization of laboratory dates is conducted to correct for isotope fractionation effects (Morlan pers. com., Stuiver and Polach 1977). Isotope fractionation refers to the chemical process of recombining selected isotopes from atmospheric CO2 into new structures (Chisholm *et al.* 1986) in living organisms. Bison bone collagen used for radiocarbon dating, for example, does not have the same C13 ratio as the plants that the bison ate. Different plants recombine isotopes in different ways just as herbivores recombine the isotopes from these plants. These subtle variations are detectable in radiocarbon samples. Consequently, dates on wood or charcoal yield different ages from dates derived from bone samples even when the items are from the same temporal event. Normalization is used to convert dates on bone collagen samples into an age equivalent to a wood sample. The normalization of bone collagen dates into equivalent charcoal or wood derived dates is a simple procedure providing that a Delta C13 relative to the PDB standard is available. The PDB standard is a known value based on a marine limestone from South Carolina (Chisholm *et al*. 1986: 197). Radiocarbon dates on bone must be normalized before calibrating the dates to calendrical years.

The Delta C13 relative to the PDB standard is also useful in aiding palaeoenvironmental reconstruction as it can be used to determine the primary types of grasses eaten by herbivores (Chisholm *et al.* 1986). The premise is that xeric (C4) and mesic (C3) grasses recombine atmospheric CO2 differently which results in markedly different Delta C13 signatures. Chisholm *et al.* (1986: 197) note that the numeric value for Delta C13 relative to PDB for C3 (mesic) grasses is -26.5 ‰ (parts per mil) while C4 (xeric) grasses have a value of -12.5 ‰. Because the plant isotopes go through further recombination when converted physiologically into bison bone collagen, they note that a "collagen enrichment" increment of +5 parts per mil is needed to convert plant-based Delta C13 ratios to bone collagen based ratios. Therefore a herbivore that ate only C3 grasses should have a Delta C13 relative to PDB of -21.5 ‰ while a herbivore that ate C4 grasses exclusively should have a Delta C13 relative to PDB of -7.5 ‰. Ratios that fall between these figures represented varied diets with combinations of both types of grasses.

When a radiocarbon sample is processed, the resultant age is first specified in radiocarbon years. Radiocarbon years differ to varying degrees from calendrical years. Therefore, radiocarbon dates are calibrated to account for fluctuations in the amount of atmospheric carbon that can alter the absolute ages of samples. Calibration tables have been created by radiocarbon dating wood samples which have been cross-dated to an absolute known age using dendrochronology. Because the actual calendrical age of the wood sample is known, the radiocarbon date can be adjusted or calibrated to make the necessary correction. The CALIB computer assisted calibration program incorporates data from dendrochronologically cross-dated wood to accurately adjust radiocarbon years to calendrical years (Stuiver and Reimer 1993: 215-230). This program has been used to calibrate radiocarbon dates from the 1996 season at DhMn-1. The program can calibrate using different data sets suited to different types of samples. Within the current document, some samples were calibrated using a bidecadal calibration data set which smoothes out the calibration curves somewhat and often lessens the number of intercept points for any given sample. The primary bidecadal data set sources used are Pearson and

Stuiver (1993), Stuiver and Pearson (1993), Pearson *et al* (1993) and Linick *et al* (1986) while other calibrated dates appear according to Morlan (1993).

Many of the radiocarbon dates run on bone used within the text were taken from sources where data regarding C13 ratios were not presented, therefore, accurate normalization of these individual dates could not be accomplished prior to calibration Instead, at the suggestion of Morlan (pers. com. 1998), an average figure of -17.2 ‰, based on measured ratios from bison and human bone from various Oxbow components, was applied to these 'raw' dates for normalization prior to calibration. For more information regarding the sources of this data see Appendix A.

At present, only two of the cultural levels excavated during 1995 and 1996 at DhMn-1 have been radiocarbon dated (Table 5.1). A level containing Oxbow complex material was dated using the left tibia of a bison. The tibia, which weighed 378.5 grams, was situated between portions of five diagnostic basally concave, side-notched Oxbow projectile points in 6 adjacent units. The degree of variation in depth for the points (121 cm to 141 cm below datum) is due to the downward north to south slope of the stratigraphy. The tibia was from 128 cm below datum in unit 99N 29E in the center of the point scatter. The sample was submitted to the Saskatchewan Research Council's radiocarbon dating facility at the University of Saskatchewan on February 13th, 1997. The current pretreatment protocol used by the SRC for bone samples is to extract bone collagen in a solubilized state to reduce the chance of contamination and then run the sample (Zimmer, pers. com. 1997). The result, was that sample S-3648 returned an age of 3760+/-80 rcybp with a Delta C13 result of -18.05 expressed relative to PDB. The Delta C13 result indicates that the bison specimen was eating a higher percentage of mesic (C3) grasses (over 75%) than xeric (C4) grasses. This may mean that bison simply migrated from xeric to mesic areas throughout a seasonal round or, it may indicate a moist local environment at the time of the Oxbow complex occupation. The normalized radiocarbon age for the sample is 3870+/- 80 rcybp (S-3648). The calibrated age of the sample is S-3648 cal: 4513, 4412 [4277] 4147, 3994 BP. Therefore, there is a 95.4% probability that the calendrical age of the sampled bone falls between 3994 BP and 4513 BP.

Lab No.	Cultural Affiliation	Material Dated	Date Collected	Uncalibrated Age (rcybp)	Normalized Age (rcybp)	Calibrated Age@2 Sigma (Calendrical Years)
S-44	Oxbow? Mummy Cave?	Charcoal	Jul-56	5100+/- 210	N/A	
	or Contaminated?		Jul-56	5350+/- 250	N/A	
			Average:	5200+/- 130	N/A	S-44:cal 6289 [5947] 5655 BP
S-3648	Oxbow	Bone Collagen	Aug-96	3760+/- 80	3870+/- 80	S-3648:cal 4513 [4277] 3994 BP
S-3644	Unknown	Bone Collagen	Aug-96	6810+/- 90	6985+/-90	S-3644:cal 7934 [7761] 7585 BP

Table 5.1: Summary of radiocarbon dates from DhMn-1. Sources cited include S-44 uncalibrated (Nero and McCorquodale 1958), S-44 calibrated (Morlan 1993).

A bone sample from the level immediately below the Oxbow level was also submitted to the SRC for processing. The sample was again a bison tibia weighing 321.4 grams and was recovered from a depth of 153 cm below datum. The same pretreatment protocol was followed. The calculated age of the sample suggested that the underlying palaeosol was much older. This tibia (S-3644) generated a measured age of 6810+/- 90 rcybp with a Delta C13 result of -14 relative to PDB standard. The C13 ratio for this sample indicates that this bison specimen was eating a higher percentage of xeric C4 grasses

(50%) such as buffalo grass (*Bouteloua sp.*) (Morlan pers. com.), than local bison were eating during later Oxbow times. This suggests that conditions during this early period were considerably drier than during the Oxbow occupation discussed above. The normalized radiocarbon age for S-3644 is 6985 +/- 90 rcybp. The calibrated age of this specimen is S-3644 cal: 7934, 7899 [7761] 7663, 7585 BP. Therefore, there is a 95.4% probability that the calendrical age for the specimen falls between 7585 BP and 7934 BP. It is important to note that the bones from this level do not appear to be culturally modified and were, in fact, articulated. While some obvious cultural material, including a projectile point preform and smashed and burned bone were recovered from this arbitrary level, it may have came from a large rodent disturbance. Therefore, the level cannot conclusively be assigned to any cultural complex.

It should be noted that the Saskatchewan Museum of Natural History excavations at DhMn-1 produced a radiocarbon date on charcoal from a hearth feature. The museum date, S-44: 5200 +/- 130 rcybp, is the average of two runs of 5100 +/- 210 and 5350 +/- 250 rcybp (Nero and McCorquodale 1958: 87). The date has been calibrated to S-44: cal 6289 [5947] 5655 BP (Morlan 1993). This will be discussed in greater detail in chapter seven. For a more complete list of Oxbow complex radiocarbon dates see Appendix A.

5.6 Palaeoenvironmental Reconstruction

5.6.1 Introduction

Palaeoenvironmental reconstruction is a crucial component of any archaeological study. The information yielded by such studies can strongly influence the interpretation of cultural remains from each given time period and area. A variety of disciplines including palynology, paleolimnology, paleohydrology, geomorphology, plant macrofossil analysis, and faunal analysis, are used to generate a picture of the climatic conditions of the past. While the study of archaeological remains seems perfectly suited to palaeoenvironmental interpretation, the adaptability of humans to all types of conditions makes ecological reconstructions based on archaeological material less straight forward than strictly biological or palynological studies. This is particularly true in cases where climatic change has not led to noticeable shifts in subsistence strategies.

Wilson and Dijks (1993: 37-61) note that the cyclic nature of climates within the Palliser Triangle have served as an "environmental-cultural pump" since the time of initial human occupation. By this they mean that the nature of climatic change has greatly influenced human population in the area, at times supporting large populations with a rich and exploitable resource base while at other times, the area has sustained only minimal human populations primarily due to xeric conditions with few plants or animals available for human use.

The earliest dated material (S-3644 cal: 7934 [7761] 7585 BP) at DhMn-1 dates to the first half of the Altithermal. As discussed above, the C13 relative to PDB ratio suggests that bison were grazing on forage consisting of a higher percentage (50%) of xeric grasses than during the Oxbow period (25%) at this location. It is important to discuss the palaeoenvironmental conditions of the period, as this radiocarbon date and the strata below it have implications for archaeological studies of the early Altithermal.

Furthermore, many of the subsistence adaptations utilized by later Oxbow groups likely have origins during this period, after which the return to more mesic conditions during the successive Medithermal period (Antevs 1955) signals the rapid development of the Oxbow complex on the Northern Plains.

Numerous studies have been conducted in a variety of locations throughout the Plains. Areas of high relief, such as the Cypress Hills, are often good locations for paleoenvironmental studies (Sauchyn and Sauchyn, 1991). Sauchyn and Sauchyn state that the Cypress Hills contain a great deal of botanical diversity, because of the differential aspects of slopes and variation in elevation. This is in contrast to the surrounding lowlands with little diversification in floral material or topography. Consequently, each individual ecotone in the hills reacts differently to environmental change and in so doing leaves its own unique sedimentary record of the past.

5.6.2 The Early to Middle Holocene

The study of Harris Lake, situated in the Cypress Hills, has yielded a substantial amount of information on Saskatchewan's climatic conditions during the Holocene. The lake offers a complete depositional record of sediments originating at 9120 BP. The initial sequence from the lake (zone one 9120-7700 BP) is representative of a moist, *Populus* (poplar)-grassland-shrub environment which gradually transformed into a more xeric grassland environment during the Altithermal. The period spanning from 7700 BP to 5000 BP was characterized by the increase in xeric grasses and saline-tolerant plant species (Sauchyn and Sauchyn 1991) as well as an increased amount of geomorphic activity (Sauchyn 1990). Specifically, they note a sharp decline in *Populus* and *Araceae* pollen, both of which are generally found in moist areas such as riverine or swamp environments, and an increase in herb species (ie: *Cyperaceae, Gramineae*) between 7700 and 5000 BP. Sauchyn and Sauchyn (1991) suggest that maximum aridity was reached between 7700 and 6800 BP when *Araceae, Myriophyllum, Triglochin,* and *Sphagnum* all were at minimum percentages. They note, however, that *Pinus contorta* (lodge pole pine) and *Picea glauca* (white spruce) may have been present in Cypress Hills in small numbers throughout the Altithermal. The sediment record of the basin indicates that Harris Lake was never completely desiccated during the Altithermal but did experience periods of hypersalinity (Sauchyn 1990, Last and Sauchyn 1993). Last and Sauchyn (1993) postulate that the continued existence of the body of water throughout the mid-Holocene is likely due to the fact that it is fed by a subsurface source of water and surface runoff or precipitation was not necessary for maintaining lake levels.

Vance (1991: 137-140) discussed the importance of subsurface water supplies for the maintenance of lake levels during periods of drought and concluded that, although deep bedrock aquifers are likely a more reliable source of groundwater during dry spells, little data is available which links these stable sources with prairie lakes. Vance noted that chemical analysis of the sedimentary record should indicate which sources of groundwater were prevalent at given intervals since trace elements of the formations in which the water occurred should be present in the sediments. He suspected that, most often, such lakes are supplied by surface runoff, precipitation, and shallow aquifers that are just as susceptible to drought as surface water basins.

Sheehan (1994) has recently raised the issue of the cultural importance of aquifers and aquifer-fed springs during the Altithermal south of the border. Interestingly, Wettlaufer and Mayer-Oakes (1960) note that the Long Creek site is located in close proximity to an aquifer-fed spring. Christiansen *et al.* (1969: 68) note that an extremely large and major aquifer system capable of yielding more than 900 liters per well per minute underlies the southern corner of the province including areas in and around Long Creek, Oxbow, and Moose Mountain. On a related theme, Artz (1995) states that middle and early Holocene deposits are more likely to be preserved on smaller tributaries of river systems than on the main channels. The Long Creek site fits both criteria and therefore offers potential insight into the selection of the location as a campsite during the mid Holocene (ie: the presence of an aquifer) as well as an offering an explanation as to why the site was not destroyed by geomorphic activity as, undoubtedly, other sites on major river systems were.

In reference to geomorphological activity in the area of Cypress Hills, Sauchyn (1990) suggests that the increased rates of sedimentation evident in the cores of Harris Lake between 6800 and 5120 BP are a reflection of a period of accelerated erosion. The low percentage of organic material present in these sediments is indicative of poor ground cover which is often associated with aeolian and alluvial erosion. The fact that erosion accelerated after the period of maximum aridity is believed to be the result of increased landslide activity due to the combination of sparse ground cover and a return of slightly more mesic conditions. The same conditions that existed in the Cypress Hills may be responsible for the lack of buried soils attributable to a period spanning from perhaps as long as 8000 to 4500 BP at DhMn-1. The stratigraphy indicates that soils simply didn't develop during this period or that soils that did develop were scoured away.

A palaeohydrological study which yielded similar results was conducted on sediments from Chappice Lake, a small saline basin located on an upland in southeastern Alberta near the town of Medicine Hat (Vance *et al.* 1992, 1993). This multi-disciplinary study used the combined approaches of palynology, palaeobotony, sediment mineralogy, geochemistry, and lithology to analyze cores extracted from the lake sediments. Vance *et al.* (1992, 1993) reconstructed the sequence of palaeohydrological events within the basin by interpreting the palynological record. Using indicator species, they were able to determine relative moisture conditions and temperature for the area as well as reinforce hypotheses on lake salinity during the mid-Holocene. Based on the percentages of Cheno/Am and *Ambrosia* (ragweed/tumbleweed) pollen in pollen zone one (7300-6000 BP), they concluded that the initial phase of the basin was generally characterized by xeric conditions with low-water levels but was prone to drastic annual water level fluctuations. Episodes of extreme aridity and increased overall temperature (including periodic episodes of complete lake desiccation) that were interspersed with cooler periods with comparatively fresh, high-water stands are apparent in the sediment record for this period (7300-6000 BP) (Vance et al. 1992). Altogether, a total of 4 periods of complete desiccation between 7000 and 6250 BP were noted. The Chappice Lake sediments also indicate that the latter half of the Altithermal (6000-4400 BP) was considerably more stable than the former half and contained no noticeable periods of desiccation. While temperatures remained higher and precipitation remained lower than at present, Vance *et al.* (1992) propose that precipitation and groundwater influx rates roughly equaled or were slightly higher than evaporation rates by about 6000 BP resulting in a perennial lake with water levels lower than that of today.

A multidisciplinary study of the Holocene sediments of Moon Lake in North Dakota further supports the concept of maximum aridity occurring on the Northern Plains around 7100 BP, followed by a period of fluctuating aridity between 7100 and 4600 BP (Valero-Garces *et al.* 1997). This group note that distinct arid phases occurred at 6600-6200 BP, 5400-5200 BP, and 4800-4600 BP with intermittent wetter phases. The beginning of this period is marked by the disappearance of Oak pollen and a corresponding appearance of *Ruppia* pollen and the establishment of a dry grassland environment by approximately 8000 BP.

Studies of channel development along the Souris River suggest that extremely rapid alluvial deposition occurred during the early to mid Holocene (Boettger 1986, McFaul 1990, and Shay *et al.* 1990). Boettger (1986) notes that organic material radiocarbon dated to 8840 +/- 100 BP, was recovered from 8 to 9 meters below the present valley floor. Bison bone recovered from an Altithermal aged buried soil on an alluvial terrace above the valley floor at DhMn-1 returned an age of S-3644: cal 7934 [7761] 7585 BP. This suggests that over nine meters of these thick sandy deposits accumulated in perhaps as little as 2000 years. Boettger (1986) also notes locations on the Souris River where tributary alluvial fan deposition may have dammed the main channel creating long, shallow lakes.

A palaeoecological study by Zoltai and Vitt (1990) focuses on the development of peatlands along the margins of the northern Great Plains in Canada and offers some insight into the palaeoecological conditions of the mid-Holocene in this boundary region. The authors note that the rapidly fluctuating water table of the Altithermal was not conducive to peat formation based on work by Danman (1979) and Malmer (1986). This is because increased fluctuation of the water table promotes decomposition of the plant material which forms the essential substructure of bogs. In other words, the development of fens (peat bogs) is dependent on a stable water level where precipitation meets or exceeds the rate of evaporation. Like many palynological studies, this peat study indicates that climatic conditions of the Altithermal were experienced first and subsided first in the West. The oldest peat accumulations included in the study occurred along the eastern slopes of the Rocky Mountains where the extreme climatic conditions of the Altithermal were succeeded by moister conditions around 8000 BP (Zoltai and Vitt 1990). The study clearly shows an earlier development of peatlands in more northerly latitudes at 6000 BP. A boundary limiting the southern extent of Altithermal-aged fen deposits cross-cuts Saskatchewan at about 54°30' N latitude below which, fen deposits are generally younger than 6000 BP. This boundary corresponds closely to the northerly extension of grassland environments proposed by Ritchie (1976). Ritchie noted that the grassland/parkland boundary was north of Prince Albert at approximately 6500 BP, an area which is currently inhabited by boreal forest species.

Zoltai and Vitt (1990) used this boundary in comparison with the present limit of fen development to create an Altithermal climatic model for the area which indicated minimum acceptable amounts of climatic change. They reached a number of significant conclusions. First, they determined the overall temperature increase in terms of "growing degree days" to conclude that, in the peripheral areas, the number of growing degree days was 6-20% higher during the mid Holocene than at present. Second, they calculated that Altithermal precipitation may have been 19% lower in Saskatchewan but five percent higher in Manitoba than present. These figures were then combined to calculate an "aridity index" for all of the area of study which suggested that conditions in those areas were 17-29% more arid during the Altithermal (Zoltai and Vitt 1990).

A number of interesting conclusions can be drawn based on peat studies conducted by Kuhry *et al.* (1992, 1993). Peat accumulations at La Ronge, Saskatchewan, Gypsumville and Porcupine Mountain, Manitoba, all indicate that true bog conditions did not develop in these areas until 6000 BP, prior to which, grassland/parkland conditions persisted. Kuhry *et al.* (1992) note that, during the grassland/parkland phase, the basins contained marsh vegetation but were highly susceptible to drought. Analysis of pollen from the basal levels of these bogs suggest that the grassland/parkland ecosystem that existed in these areas at around 6000 BP, has no modern analog. They hypothesize that stands of boreal forest and stands of deciduous forest formed bluffs in a surrounding grassland environment (Kuhry *et al.* 1992). This is an interesting idea which could help to explain the substantial percentages of *Pinus* pollen at many locations which are thought to have been xeric grassland environments during the Altithermal.

Whitlock and Bartlein (1993) studied the variability of climatic change during the early to mid-Holocene in the Yellowstone region of northwest Wyoming. They note that areas where divergent topographic regions intersect, such as the mountains/foothills region, exhibited different types of climatic change during the Altithermal. They suggest that, between 12000 and 6000 BP, conditions were such that the perihelion (the area of the earth closest to the sun) was located in the Northern Hemisphere during the summer months. Theoretically this condition, which is opposite of the current situation, would have effectively increased summer radiation, increased summer temperatures and decreased precipitation. However, the study suggests that the climatic regimes which exist today, were merely amplified during the mid-Holocene. Areas that are currently dry during the summer months were simply drier, and wet areas (such as the Pacific Coast) were wetter. Similar conclusions were reached by the COHMAP members in their study of global climatic change over the last 18000 years (COHMAP 1988) . They noted that seasonality was intensified during the early Holocene (9000 BP) as a northern summer perihelion and a slight increase in the tilt of the earth caused a rise in July solar radiation of about eight percent and decline of eight percent in January. The radiation maximum was apparently competing with remnant glacial ice and other boundary conditions for control over central North American weather systems. Furthermore, the heightened contrast between land mass and ocean surface temperatures created strong, dominant westerlies throughout the early and mid- Holocene. The westerlies which probably brought rain to the western mountain areas, may have caused substantial aeolian erosion on the dry plains. This model attempted to explain the time-transgressive nature, and regional variation of climatic change based on topography and proximity to the remnant ice mass.

5.6.3 The Late Holocene

All of the aforementioned palaeoenvironmental studies suggest that the intense xeric conditions of the early Altithermal eventually gave way to cooler, moister conditions by about 5000 years ago. Last and Schweyen (1985: 232) studied sediments from Waldsea Lake in east central Saskatchewan and noted that lake levels remained lower at 4000 BP than at present and were relatively unstable until 3000 BP. By 3000 BP, lake levels had risen and stabilized and pollen records indicate that the climate had continued toward more mesic conditions since the end of the Altithermal. During this mesic period, the vegetation around Waldsea Lake showed an increase in boreal species such as pine and spruce and a corresponding decrease in grasses due to cooler, moister conditions. The researchers note that a brief return to more xeric grassland conditions occurred between 2800 and 2000 BP (Last and Schweyen 1985: 233). Finally, by 2000 BP, the modern natural environment had been established dominated by pine, birch, grass and sage pollen. They also note that water levels continued to fluctuate somewhat to the present.

Similarly, a recent study of Devils Lake in eastern North Dakota indicates that the high saline, dry grassland environment which was in existence at 8000 BP, showed a gradual trend toward low salinity, slightly more mesic conditions toward 4500 BP, with minimum salinity and an associated rise in the water level recorded for the period between 4500 and 3500 BP (Haskell *et al.* 1996). Like the Waldsea Lake study, Haskell *et al.* (1996: 190) note an increase in salinity and corresponding lowered water levels at Devils Lake beginning at approximately 2500 BP. Moon Lake in North Dakota offers further evidence to support the work at Waldsea Lake and Devils Lake which indicates an increase in effective moisture levels after 4400 BP (Valero-Garces *et al.* 1997). Moon Lake levels continued to fluctuate between 3900 and 3500 BP but the general trend was toward increased moisture levels. Again, a period of increased aridity is noted between 3500 and 2000 BP (Valero-Garces *et al.* 1997:367). Lake levels rose and remained high between 2000 and 1200 BP but dropped at around 1000 BP. Valero-Garces *et al.* (1997:367) note another increase in effective moisture between 720 and 480 BP and a decrease between 450 and 300 BP. Though not as thoroughly radiocarbon dated as other studies, research regarding the sedimentological evolution of the Medicine Lake basin in South Dakota showed that climatic episodes recognized at Waldsea Lake and Devils Lake were paralleled by similar episodes in eastern South Dakota (Valero-Garces *et al.* 1995). A common denominator in all of the aforementioned studies is that they suggest that periodic episodes of increased aridity were punctuated by humid periods and conversely, episodes of increased humidity were punctuated by arid periods over the last 4500 years.

In the Cypress Hills, Harris Lake sediments indicate that after about 5000 BP, the warmer and drier conditions of the Altithermal were replaced with cooler and moister conditions (Last and Sauchyn 1993: 23-24). The cool and moist conditions led to a period of tremendous geomorphic activity, including landslides, as hillslopes adjusted. Consequently, detrital sedimentation within the lake basin was most intense during the period from 4500 -3000 BP (Sauchyn 1990). Last and Sauchyn (1993: 36) note that sedimentation due to landslides decreased abruptly around 4,000 BP and pollen records suggest that this change occurred in response to forestation of the watershed (Sauchyn and Sauchyn 1991). By 3200 BP, modern vegetation and climate were established (Sauchyn and Sauchyn 1991).

Picha and Gregg (1993) conducted a study of the chronostratigraphy of floodplain sediments along the James River in North Dakota and noted that the alluvial sediments above the present water level are all attributable to post 5500 BP alluviation and that middle and early Holocene deposits would be extremely deeply buried. Poorly developed buried soils encountered at the present water level are attributed to rapid infilling during the last episodes of the middle Holocene while more highly developed buried soil above these regosols are believed to have begun development between 4000 and 3500 BP (Picha and Gregg 1993: 207).

5.6.4 Palaeoenvironmental Reconstruction Based on Fine-Screen Samples

The reconstruction of palaeoenvironmental conditions based on microfaunal remains is becoming more and more commonplace in archaeological studies. Often such reconstructions are possible only in areas which exhibit a large degree of climatic change over time and particularly in areas with a climate-restricted biome with a limited number of species inhabiting the zone. Unfortunately, climatic reconstruction based on microremains from DhMn-1 is of limited utility as this riverine environment supports a much more diverse group of animal and plant species. Where possible, however, every effort has been made to discuss specific habitat requirements for species identified from within each cultural level. By far the most numerous microfaunal remains were isolated teeth of microtine rodents. The identification of microtine rodents to the level of species is extremely difficult using isolated teeth and virtually impossible at present using postcranial elements. In order to avoid the presentation of misidentified species, most of the vole specimens are identified only to the level of subfamily.

CHAPTER SIX

THE 1995 AND 1996 CULTURAL ASSEMBLAGES

6.1 Introduction to the Cultural Assemblages

This chapter presents the analysis of artifacts recovered during the 1995 and 1996 field seasons at DhMn-1. It includes material from seven well-defined cultural levels as well as materials which may be associated with a weakly developed Regosol recorded in a deep test unit at a level below the lowest excavated component. First and foremost, the analyses are presented according to cultural levels which are further subdivided into lithics, fauna, and features. Re-analysis of the material collected at the site by the Saskatchewan Museum of Natural History in 1956 appears in chapter seven.

The variety of animal species recovered from each cultural level at DhMn-1 changes considerably over time. This not only correlates with environmental changes but also indicates variability in human selection of subsistence resources. For each level, the minimum number of individuals (MNI) and the number of identified specimens (NISP) has been calculated for every identified species. Lyman (1994) illustrated several problems associated with the terminology used in quantitative zooarchaeology. The method of calculating MNI's used here follows Grayson (1984) where the minimum number of individuals is based on the number of animals that would actually be required to account for the identified elements or portions of elements within the assemblage. In some instances, extreme size differences and other developmental characteristics can account for recognizable individuals. For example, a small juvenile bison unfused left metacarpal represents an entire individual and can not be paired with a large right fused metacarpal, therefore, modified MNI's (Hesse and Wapnish 1985:114) may be presented for some levels. Data for levels with large numbers of identified elements is presented in chart form for readability. Information pertaining to cultural modification is also presented there.

The use of fine-screen sampling techniques at archaeological sites has led to substantial advancements in palaeoenvironmental reconstruction, palaeodietary studies, and lithic technological studies. Generally, the remains of microfauna, carbonized flora and plant macrofossils are analyzed to determine the extent of environmental change that has taken place at a given location. To accomplish this, samples are examined, specimens are conclusively identified and their modern ranges are determined in order assess their habitat requirements. These are then used to generate a model of the site area as it was when the specimens entered the archaeological record. Processed fine-screen samples from DhMn-1 produced specimens of several microvertebrate species.

6.2 Cultural Level One

Most of the palaeosols contained, at least, a minimal amount of cultural material. Unfortunately, however, the cultural material did not always include diagnostic artifacts for each level. DhMn-1's uppermost palaeosol (cultural level one) was encountered only in unit 98N 31E because of the way the bank had eroded. It is probable that artifacts in good stratigraphic context exist further east up into the terrace; however, the area is currently buried beneath a gravel road and is, therefore, inaccessible.

6.2.1 Cultural Level One Lithics

6.2.1.1 Debitage:

Level one contains no diagnostic artifacts and a minimal amount of lithic material which includes one piece of chert debitage (0.9 grams), and one cortical quartzite flake (0.8 grams).

6.2.2 Cultural Level One Faunal Remains

6.2.2.1 Identified Faunal Remains:

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison.*
MNI = 1. NISP = 2.
The identifiable bison bone elements recovered in level one include one sesamoid (3.2 g) and one fragment of an upper right premolar (3.2 g).

Phylum Mollusca, Class Pelecypoda, Family Unionidae. (freshwater clams)
MNI = 1.
Freshwater shellfish remains include five pieces of burned mollusk shell weighing a total of 1.4 grams.

6.2.2.2 *Unidentified Faunal Remains:*

Other vertebrate remains include nineteen pieces of unburned, pulverized unidentifiable bone weighing a total of 9.2 grams and four unburned tooth fragments (1.2 g.).

6.2.3 *Level One Summary*

The sample from cultural level one is too small to be useful for any sort of analysis. Excavation units further east, in an area currently buried by a road, may yield more information about this occupation but until then only very tenuous generalizations can be made about it. The presence of smashed and burned bone may indicate that activities such as bone grease extraction were conducted at the site during this period of occupation but again the small amount of bone recovered and the lack of any associated features make this assessment highly speculative. The recovery of processed mollusk shell (burned) suggests that the season of the occupation was most likely between late spring and early fall during which time these items could be collected from the river. The sparse nature of the assemblage may indicate a short-term occupation or simply that the main activity areas were outside of the excavation block which were not sampled.

6.3 Cultural Level Two

6.3.1 Level Two Lithics

6.3.1.1 Debitage:

No diagnostic artifacts were recovered from level two; however, a fragment of a finely made unifacially flaked knife (3.1 grams) made of Knife River Flint (KRF) was recovered along with 57 pieces of KRF debitage including pressure flakes, thinning flakes, and shatter weighing a total of 19.0 grams. Other knappable lithic materials include 16 flakes of white and brown banded chalcedony (7.0 g.), two white chalcedony flakes (1.2 g.), which both may be variations within Knife River Flint, four Swan River Chert (SRC) flakes (3.5 g.), four olive coloured pebble chert flakes (5.8 g.),one black pebble chert decortification flake (1.0 g.), one decortification flake of a silica nodule (4.5 g.), one purple quartzite flake (3.0 g.), and one silicified wood cortical flake (0.5 g.). Admittedly, this sample size is very small; however, it appears to indicate a preference for Knife River Flint for stone tool production during this occupation.

6.3.1.2 Hammerstone and Anvil:

One 230.1 gram quartzite hammerstone with battering at one end was recovered from unit 97N 31E. The hammerstone was associated with a small hearth pit feature. Hammerstones likely served a variety of uses including the removal of large flakes from a lithic core during the primary reduction sequence of flintknapping. The presence of flakes, shatter and broken tools suggest that flintknapping was one of its functions during this occupation. Furthermore, hammerstones could be used to smash bones for marrow and grease removal as well as any number of vegetal processing activities such as crushing chokecherries to make the pits easier on one's teeth.

Also associated with this level are two pieces of a limestone block (795.0 g) which may have served as an anvil for splitting chert pebbles until it broke and was discarded. Chert pebbles contain high quality lithic material beneath the cortex. However, the rounded shape of a river pebble does not usually exhibit the types of angles necessary for flintknapping and, therefore, must be split into halves. Flat chert pebbles can be split by standing them on edge on a stone anvil while striking the upper edge with a hammerstone. In doing so, the anvil and the hammerstone are subject to a large amount of stress and may be governed by the same principles of concoidal fracture that make flintknapping possible. The limestone pieces in question show this concoidal breakage pattern. This idea is supported by the presence of pebble chert debitage within the assemblage.

6.3.1.3 Fire-Cracked Rock:

A total of 511.3 grams of fire-cracked rock (FCR) was recovered from this level, including a single piece of granite weighing 493.7 grams which was recovered from a hearth feature.

6.3.2 Level Two Features

Level two contained a well-defined pit-hearth in unit 97N 31E. The pit was approximately 65 cm in diameter and bowl-shaped, extending approximately 20 cm below the contemporary ground surface (see chapter five Figure 5.1 and Plate 5.2). A layer of oxidized matrix was visible along the base of the feature, extending between 62 and 65 cm below the datum. The feature contained several carbonized twigs (9.9 grams), and a small piece of fire-cracked rock (493.7 grams). Samples of the oxidized matrix were taken but have not been thoroughly examined. Pit-hearths obviously served a great many functions, varying from a basic heat source to a kiln for firing pottery. Consequently, the exact use of this feature is not clear. The feature is small in comparison to roasting pits described by Wandsnider (1997) and was probably too shallow to have been used as a boiling pit for grease and marrow extraction. Also, boiling pits often contain a large amount of fire-cracked rock whereas this feature contains very little. However, it may have been an associated hearth used to heat rocks prior to their immersion in a boiling pit. Interestingly, Wandsnider's (1997) overview indicates that pit-hearths were often used for cooking small rodents. Unfortunately, only one of the rodent specimens associated with this level showed any signs of burning.

6.3.3 *Cultural Level Two Faunal Remains*

6.3.3.1 *Identified Faunal Remains:*

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison.* MNI = 1. NISP = 7.

Identifiable unburned *B. bison bison* bone from this level includes two complete lower incisors (1.6 g each), two right femur shaft fragments (56.2 and 88.7 g), one rib fragment weighing 18 g, one vertebral posterior epiphysis (2.6 g), one unburned thoracic vertebrae spinous process (11.7 g), one proximal portion of a right metatarsal with a spiral fracture breakage pattern (127.0 grams), one incomplete right patella (38.3 grams), and one fragment of a first phalanx (6.0 grams).

Class Mammalia, Order Carnivora, Family Canidae, cf. *Canis* sp.
MNI =1 NISP = 1
A metapodial shaft fragment (0.8 grams) appears to represent the genus *Canis.*

Because of the size range within both domestic and wild canid species, it is extremely difficult to assign any post-cranial elements beyond the genus level. Therefore, adjectives such as small, medium and large are frequently used to describe these elements within the genus in relationship to one another to aid in interpretation. For example, domestic dogs can fall within the size range for wolf (*Canis lupus*), coyote (*Canis latrans*), or even fox (*Vulpes* sp.) and it is often difficult to readily distinguish them, so simple size categories are used to partially separate canid remains. The metapodial fragment from this level appears to be similar in size to a wolf and is considered to represent a large canid.

Class Mammalia, Order Insectivora, Family Soricidae, *Microsorex hoyi.*
(Pigmy Shrew) MNI = 1. NISP = 2.
Remains include one unburned mandible fragment and one unburned maxilla fragment.

Class Mammalia, Order Rodentia, Family Cricetidae, Subfamily Microtinae.

Clethrionomys gapperi. (Gapper's Red-Backed Vole)

MNI = 1. NISP = 1.

Remains include one unburned left mandibular third molar.

Class Mammalia, Order Rodentia, Family Cricetidae. Indeterminate genus. (mice and voles)

MNI = 1. NISP = 7.

Remains include two unburned caudal vertebrae, one unburned calcaneus, one unburned lower right incisor, one unburned upper incisor, one unburned metapodial and one burned metapodial.

Class Reptilia, Order Squamata, Family Colubridae, cf. *Thamnophis* sp. (non-venomous snake)

MNI = 1. NISP = 2.

Remains include one unburned left mandible fragment and one unburned right mandible fragment.

Phylum Mollusca, Class Pelecypoda, Family Unionidae. (freshwater clam)

MNI = 1

Freshwater mollusk remains include four fragments of mollusk shell

Phylum Mollusca, Class Gastropoda. (snail)

MNI = 1

Remains include one complete snail shell

6.3.3.2 *Unidentified Faunal Remains:*

The remainder of the bone from the level is pulverized and very fragile. There are 570 fragments of nonburned bone weighing a total of 184.4 grams. Burned bone is represented by 50 small fragments weighing a total of 14.9 grams and a single fragment of burned tooth (0.7 g.).

6.3.4 *Level Two Discussion*

Not surprisingly, *Bison bison bison* , with an MNI of one, represents the largest source of meat protein and fat during this occupation. The broken metatarsal is consistent with breakage patterns described by Binford (1981:148-166) for marrow extraction, in which, the metapodial is held firmly in one hand above the ground and struck with a hard implement toward the distal, end breaking it off. This method is apparently favored by the Nunamiut hunters because it keeps the marrow plug from falling onto the ground.

Unfortunately, the identified microvertebrates from this level aid very little in palaeoenvironmental reconstruction as both *Microsorex hoyi* and *Clethrionomys gapperi* inhabit a variety of ecozones ranging from grasslands to coniferous forests (Banfield 1987: 20-21, 180-184). It is difficult to say whether or not the microfauna represents any culturally-relevant entity. Evidence for rodent procurement certainly exists in the ethnographic record (Mandelbaum 1979: 51, Wilson 1978: 165-170, Weitzner 1979: 199); however, these specimens show no signs of cultural modification and may simply represent animals that died.around the time of occupation.

Weitzner (1979: 199) notes that small mice were hunted for practice but not eaten among the Hidatsa. Stahl (1982: 822-829) further suggests that the cyclic reproduction pattern of voles can lead to extremely high numbers of animals within a given area, making them an easily obtainable food source during particular years. Indeed, tests indicate that the percentage of edible meat verses body weight for small rodents and insectivores is often in the region of 80-90% (Stahl 1982: 822-829). Morlan (1994b: 139) suggests that a set of criteria including the presence of burned teeth and burned distal elements such as metapodials and phalanges may help support the argument for small rodents as a human food resource. Within level 3, only a single charred Cricetid metapodial was recovered, unfortunately offering little to substantiate the possibility of human food procurement of rodents during this occupation. It is not unreasonable to suggest that these remains may have been deposited at the site in the form of scats of larger animals.

6.3.5 Level Two Summary

The small sample size for cultural level two makes interpretation of this occupation difficult; however, the presence of flintknapping debitage and the recovery of a well-used hammerstone and a possible anvil stone indicate that lithic tool production or modification took place. The group responsible for the assemblage likely had knowledge of the Knife River Flint (KRF) quarry area in North Dakota or trade relations with others who did, as KRF is the most common lithic material represented. The combined presence of the pit-hearth, fire-cracked rock, the hammerstone and anvil, and comminuted bone indicate that activities surrounding bone grease extraction took place during this occupation, although no boiling pit was discovered (for further information see Vehik 1977: 169-182, Binford 1981: 166). The spiral fractured metatarsal exhibits a "bayonet" type break consistent with ethnographic accounts of bone breakage for the purpose of marrow extraction (Binford 1981: 148-166). Unfortunately, the cultural affiliation remains unknown for this level as no diagnostic artifacts were recovered and no samples were submitted for radiocarbon dating. It is highly probable that much more material from this occupation exists beneath a road directly east of the excavation block.

6.4 Cultural Level Three

6.4.1 Cultural Level Three Lithics

6.4.1.1 Debitage:

No diagnostic artifacts were recovered from cultural level three. The following list identifies all of the flintknapped lithic material recovered from the level: 10 Knife River Flint (KRF) thinning flakes (8.5 g), two KRF pressure flakes (0.2 g.), one KRF shatter (0.1 g.), two KRF unclassified flakes (0.6 g.), two heat-treated brown chalcedony decortication flakes (4.7 g.), two heat-treated brown chalcedony shatter (0.4 g.), four generic chert shatter (3.2 g.), one Swan River Chert (SRC) pressure flake (0.2 g.), two SRC unclassified flakes (2.5 g.), three fused shale unclassified flakes (0.3 g.), one quartz shatter (6.2 g.), and one jasper unclassified flake (0.3 g.).

6.4.1.2 Fire-Cracked Rock:

Nine pieces of granite FCR weighing 266.3 grams, and two pieces of basalt FCR weighing 7.7 grams were recovered from level three. The total weight for FCR, therefore is 274.0 grams.

6.4.2 Cultural Level Three Faunal Remains

6.4.2.1 Identified Faunal Remains:

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison.*
MNI = 1. NISP = 5.
Remains include one unburned distal portion of a first phalanx (7.5 g.), one burned indeterminate vertebral centrum (9.1 g.), one left unburned fused second and third carpal (8.3 g.), one unburned nearly complete lower left third molar (26.8 g.) and one unburned complete lower incisor (1.8 g.).

Class Mammalia, Order Artiodactyla, Family indeterminate,
Remains include one burned indeterminate long bone shaft fragment with carnivore chewed surface (4.0 g.), four unburned indeterminate ungulate rib shaft fragments with cutmarks (5.5 g.), one mandible fragment which exhibits cutmarks (0.7 g.), 13 burned indeterminate ungulate tooth enamel fragments (2.8 g.) and eight unburned tooth fragments (1.9 g.).

Class Mammalia, Order Carnivora, Family Canidae, cf. *Canis* sp.
MNI = 1. NISP = 1.
Remains include one burned rib shaft fragment (0.5 g.).

Class Mammalia, Order Rodentia, Family Cricetidae, (mice and voles)
MNI = 1.
Remains include one unburned left mandible (0.1 g.) and 37 cranial fragments (0.2 g.).

Phylum Mollusca, Class Pelecypoda, Family Unionidae. (freshwater clam)
MNI = 1. NISP = 1.
Remains include one mollusk shell fragment (0.1 g.)

6.4.2.2 Unidentified Faunal Remains:

The assemblage for the level also contains 295 unburned, unidentifiable bone fragments (160.1g) and 187 burned unidentifiable bone fragments (91.4 g).

6.4.3 Cultural Level Three Discussion

Five of the bones in the assemblage for level three have cutmarks. Unfortunately, none of these can not be conclusively be assigned to species but most likely represent bison. The bison bones that are present represent distal limb elements and axial skeletal elements. This pattern is consistent with marrow removal and grease extraction activities where all major limb elements are first broken open to remove the marrow plug and later, the proximal and distal ends of these elements are pulverized and subsequently boiled to extract grease (Binford 1981: 148-166).

6.4.4 Level Three Summary

The lack of stone tools in this assemblage makes interpretation difficult. However, the presence of decortication flakes, soft hammer thinning flakes, pressure flakes, and shatter from a variety of lithic materials evidences the complete sequence of steps utilized in the tool manufacturing process. Again, the inhabitants during this occupation have links, either directly or indirectly, to the KRF quarries in North Dakota as this is the most common lithic material in the level. Comminuted bone in this and other levels suggest that bone grease extraction was a very common occurrence throughout the history of the site. The close proximity of the site to water was undoubtedly a factor in this. Oddly, however, no boiling pits were noted in any levels.

6.5 Cultural Level Four

As discussed in chapter five, cultural levels four and five are easily separated stratigraphically toward the north end of the excavation block but become increasingly difficult to separate toward the south end. Every attempt was made to follow stratigraphic levels during the excavation, but changes between these levels in matrix texture and colour were not always readily apparent, particularly under the fast-drying conditions of southeastern Saskatchewan where visible strata becomes indistinguishable from overlying deposits as it dries throughout the day. Fortunately, there appears to be a distinct sterile zone between levels four and five which can be identified using provenience information across most of the excavation.

In cases where this was necessary, it has been noted in the descriptions below.

6.5.1 Cultural Level Four Lithics

6.5.1.1 Projectile Points:

A bifacial projectile point lateral blade fragment (artifact #2346) recovered from Unit 102N 28E could not be assigned to any specific type because the basal portion of the item was not recovered (Plate 6.1: C). The point has a very shallow, narrow side-notch, a slightly convex lateral margin and is split longitudinally. This point is made of heat-treated Knife River Flint. Unfortunately, the exact provenience of this artifact is not known as it was recovered from a fine screen sample. The range of depths recorded for the fine screen sample indicate that the point is associated with cultural level four.

6.5.1.2 Scrapers:

Cultural level four contains a variety of end and sidescrapers. A finely made end/sidescraper (artifact #2170) was recovered in two pieces from unit 102N 29E. This item is made of Knife River Flint and appears to have been damaged by heat (Plate 6.1: B). The artifact is discolored to a dark grey brown and exhibits cracking and heat-spalling (potlidding: see Johnson 1993) characteristic of exposure to extreme heat and rapid cooling (Johnson 1986: 45, 1993: 56, Waldorf 1993: 10). The scraper is made on a carefully prepared flake with a prominent dorsal ridge and a smooth, longitudinally concave ventral surface. The overall shape of the tool is like an elongated

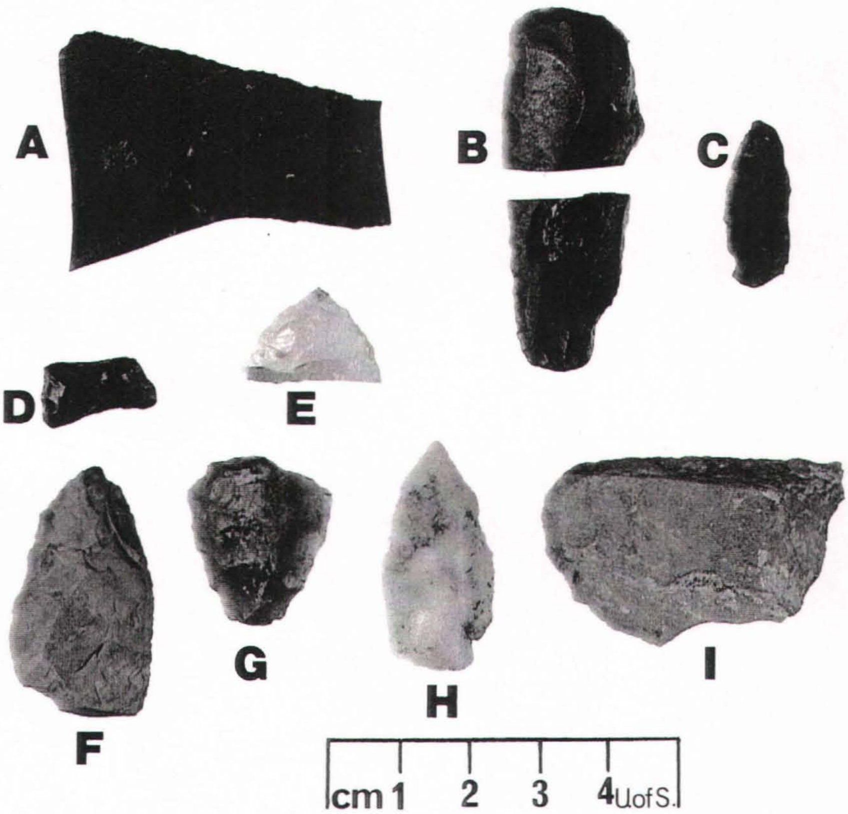


Plate 6.1: Lithic artifacts from cultural levels four (A, B, C, I), five (D,E,G,H,), and seven (F). A: Antelope Chert sidescraper (#3347), B: KRF end/sidescraper (#2170), C: KRF projectile point (#2346), D: jasper projectile point base (#3133: Hanna-type), E: white chalcedony projectile point tip (#2994), F: fused shale preform (#1641), G: KRF endscraper (#739), H: SRC preform or perforator (#1514), I: quartzite end/sidescraper (#2132).

teardrop. A slight bulb of percussion is visible on the proximal ventral surface. The distal end of the flake is unifacially retouched to create a steep, convex working edge. In transverse cross-section the item is wedge shaped. When viewed dorsally, the thick right lateral margin is covered with the cortex of the nodule while the thin left lateral margin has been unifacially pressure flaked to produce a sharp, essentially straight sidescraper. A second sidescraper (artifact # 3347)was recovered from unit 101N 28E (Plate 6.1: A). This tool is made from Antelope Chert from North Dakota (Ahler, pers. com.). Antelope Chert is a recently defined form of high quality silicified peat which often contains visible plant and shell remains (Beckes *et al.* 1987:13). Currently, this material is known from a single outcrop in MacKenzie County. Technologically, this scraper is strikingly similar to artifact # 2170 and again is made on a large, carefully prepared flake. A dorsal ridge runs the entire length of the specimen and the ventral surface is longitudinally convex. Proportionately, the artifact is very thin at 5.3 mm thick, 44.6 mm long and 33.2 mm wide. The working edge of the artifact is along the right lateral margin where it has been unifacially-retouched using pressure flaking. The left lateral margin may have been intentionally snapped off to remove the sharp, thin edge of the original flake thus providing a backed edge where the tool could be held safely. A large, crudely formed sidescraper (artifact #2132) from unit 96N 30E is likely associated with cultural level four; however, stratigraphic separation in this unit is difficult to detect due to compression and the artifact may belong to the assemblage of cultural level five. The artifact is made on a large flake of pinkish/orange quartzite that has been unifacially retouched along one lateral margin using pressure flaking to create a straight, steeply angled working edge (Plate 6.1: I). This sidescraper is technologically different from the others in that the ventral surface of the flake is the dorsal surface of the scraper. A small fragment of a tabular sidescraper (artifact # 397) was recovered from unit 100N 30E from a depth which indicates its association with cultural level four. The artifact is made from Knife River Flint and shows signs of minimal unifacial retouch along one lateral edge (not illustrated).

6.5.1.3 Debitage:

The debitage (Table 6.1) from DhMn-1 cultural level four indicates a preference for locally available Swan River Chert (46.46% by weight) as well as the fact this group had access to exotic materials such as Knife River Flint (29.81%) and Antelope Chert (4.34%) from North Dakota for stone tool production.

Material	Count	Description	Weight(g)	Percentage
Antelope Chert	1	thinning flake	3	4.34%
basalt	2	flake	2	2.89%
fused shale	1	shatter	0.5	0.72%
indeterminate chert	3	flake	0.5	0.72%
indeterminate lithic	2	flake	0.7	1.01%
jasper	4	flake	0.4	0.58%
KRF	24	flake	14.7	21.27%
KRF	3	shatter	5.9	8.54%
pebble chert	2	shatter	3.7	5.35%
petrified wood	1	shatter	1.3	1.88%
quartz	2	flake	1.1	1.59%
quartz	1	shatter	0.2	0.29%
quartzite	1	flake	1.6	2.32%
shist	1	flake	1.4	2.03%
SRC	21	flake	29	41.97%
SRC	2	shatter	3.1	4.49%
TOTAL	71		69.1	99.99%

Table 6.1: Table indicating relative abundance of material types according to lithic debitage associated with cultural level four. Percentages are calculated by weight.

6.5.1.4 *Fire-Cracked Rock:*

A total of 2079.8 grams of FCR was recovered from cultural level four. Although no hearth features were noted during the excavation of this level, the presence of FCR suggests that they exist outside of the excavation block.

6.5.2 *Cultural Level Four Faunal Remains*

6.5.2.1 *Identified Faunal Remains:*

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison*
MNI = 1, NISP =9.
Unburned bison elements include one cervical vertebra fragment (75.2 g), one right femur head (81.9 g), one left distal humerus fragment (123.4 g), one horizontal ramus of a right mandible (185.5 g), and one left occipital condyle (16.4 g). Burned bison remains include one proximal humerus fragment (5.3 g), one right radial carpal fragment (3.6 g), one complete superior sesamoid (4.3 g), and one petrous portion of the temporal bone.

Class Mammalia, Order Rodentia, Family Cricetidae, (voles)
Subfamily Arvicolinae.*
Remains include one burned and one unburned molar.

Class Mammalia, Order Rodentia, Family Cricetidae, Subfamily Arvicolinae,
Clethrionomys gapperi. *(Gapper's Red-Backed Vole)
Remains include one burned upper left first molar.

Class Mammalia, Order Rodentia, Family Cricetidae, Indeterminate genus.*
Remains include one burned upper left incisor.
* It should be noted that the above Cricetid remains may represent a single individual rather than three separate individuals.

Class Mammalia, Order Rodentia, Family Sciuridae, Indeterminate genus.
MNI = 1, NISP = 1
Remains include one third phalanx.

Class Reptilia, Order Squamata, Family Colubridae, cf. *Thamnophis* sp.
(non-venomous snake)
MNI = 1. NISP = 3.
Remains include one rib and two vertebrae.

6.5.2.2 Unidentified Faunal Remains:

Unidentified faunal remains include 618 unburned bone fragments (356.7 g), 683 burned bone fragments (341.6 g), 21 unburned tooth enamel fragments (9.3 g), and three burned tooth enamel fragments (0.7 g).

6.5.3 Cultural Level Four Discussion:

The lack of complete bison long bone elements and their representation by proximal and distal ends suggests that marrow extraction was taking place at the site during this occupation. The fact that the proximal and distal portions have not been pulverized may indicate that such bones were not being processed fully to extract grease. However, the sample size is very small and pulverized proximal and distal cancellous portions may be present in the unidentified bone samples or elsewhere in areas not excavated.

A limited amount of information can be derived from the fine-screen samples from level four as the types of animals represented are suited to a wide range of habitats and may be of little utility as palaeoenvironmental indicator species. The exact processes responsible for the deposition of these remains is difficult to assess. A single rib, and two vertebrae from a small snake were recovered from this living floor, however, the relationship to human activities at the site is unknown. The elements may represent a hibernaculum death (Morlan 1994b) although, if that were case, one should expect to recover many more vertebrae and possibly more cranial elements. Burned rodent teeth may indicate roasting activities as described by Morlan (1994b) but with such a small number (MNI = 1) represented, any claims of such activities are difficult to substantiate. Furthermore, Morlan's identification of roasted Richardson's ground squirrels from Tipperary Creek (1994b: 139) included the presence of charred teeth and distal phalanges in association with roasting pits and more importantly, practically unmodified limb elements which escaped charring because they were insulated from the extreme heat by a layer of thick flesh.

6.5.4 Cultural Level Four Summary

Unfortunately, the cultural affiliation of this level is not known, but a side-notched projectile point fragment is associated with it. The projectile is likely attributable to the Sandy Creek complex, the Besant complex or the Late Plains-Side-Notched Series (Dyck 1983) as a Hanna point was recovered from the level immediately beneath this palaeosol. In effect, the level has been bracket dated to sometime between the present and the end of the McKean/Duncan/Hanna complex calibrated at approximately 3200 years ago (Morlan 1993). The presence of numerous scrapers suggests that hide processing activities were taking place at the site during this occupation. The inclusion of extra-local lithic materials like Knife River Flint and Antelope Chert from North Dakota indicate that the site occupants had some connections to these important quarry areas. Identifiable bison bone associated with these items is limited to proximal and distal portions of limb elements and it is likely that the shafts of the bones were intentionally cracked open to attain the marrow plugs within them.

6.6 Cultural Level Five

6.6.1 Cultural Level Five Lithics

6.6.1.1 Projectile Points:

One diagnostic projectile point base (artifact #3133) recovered from unit 96N 30E has been assigned to the McKean/Duncan/Hanna complex which commonly dates to 5000-3200 calendar years BP (Morlan 1993). This bifacially worked projectile point base is of the Hanna variety and is made of red jasper (Plate 6.1: D). The point has a slightly concave base which has been thinned by removing flakes from both sides of the point along the central portion of the basal margin. The lateral edges of the base show signs of grinding. The transverse cross section of the item is biconvex. A tip of a second bifacially worked projectile point (artifact #2994) made of patinated white chalcedony was recovered from unit 96N 29E (Plate 6.1: E). This item is relatively poorly made with an undulating longitudinal cross section and an asymmetrical transverse cross section. The lateral margins of the tip are convex. Provenience measurements for this item support its association with cultural level five.

6.6.1.2 *Preforms:*

A single Swan River Chert preform (artifact # 1514) was recovered from unit 98N 29E. The item is triangular in shape with slightly convex lateral margins which terminate distally in a sharp point and a convex basal margin (Plate 6.1: H). The lithic material exhibits a waxy luster characteristic of heat treatment (Johnson 1986: 17, 50-51) and contains several crystalline structures referred to as vugs (Johnson 1986). The artifact is made on a prepared flake with remnants of a ridge running longitudinally along the dorsal surface. The ventral surface of the object is longitudinally concave. Primarily, the preform is unifacially retouched on the dorsal surface with only a minimal amount of bifacial retouch along the ventral surface of one lateral edge. The object may also have been intended for use as a perforator, but, no usewear patterns are visible.

6.6.1.3 *Bifaces:*

A small fragment of a jasper biface (artifact # 1518) was recovered from unit 98N 29E and appears to be associated with the jasper projectile point base from unit 96N 30E from cultural level five. The fragment appears to be a basal portion of a preform-sized biface and is biconvex in transverse cross section.

6.6.1.4 *Scrapers:*

A complete Knife River Flint endscraper (artifact # 739) was recovered from unit 96N 29E and appears to have been associated with cultural level five. The scraper is teardrop-shaped with a bulb of percussion visible on the proximal ventral surface (Plate 6.1: G). The ventral surface is longitudinally concave and the dorsal surface has been completely retouched to shape the object. In cross section, this item could be classified as domed. The distal working edge is very steeply beveled and exhibits both crushing and polishing associated with use.

6.6.1.5 *Debitage:*

As in level four, the debitage associated with level five (Table 6.2) indicates a heavy reliance on locally available Swan River Chert (65% by weight) with slightly less use of Knife River Flint (25%) during this occupation. Interestingly, the jasper used for manufacturing a projectile point and a biface, makes up less than 1% of the lithic debitage by weight.

6.6.1.6 *Fire-Cracked Rock:*

Just over 10.4 kg of FCR was recovered from cultural level five. As in level four, no hearth features were noted in this level; however, charcoal was frequently encountered across the living floor.

Material	Count	Description	Weight(g)	Percentage
basalt	4	flake	1.7	0.82%
fused shale	18	flake	7.4	3.57%
indeterminate chert	2	flake	0.4	0.19%
indeterminate lithic	2	flake	0.5	0.24%
jasper	13	flake	1.8	0.87%
jasper	1	shatter	0.2	0.10%
KRF	59	flake	39.7	19.13%
KRF	3	shatter	12.6	6.07%
pebble chert	1	flake	1.5	0.72%
pebble chert	1	shatter	1.5	0.72%
petrified wood	1	shatter	0.9	0.40%
quartzite	2	flake	0.5	0.24%
quartzite	1	shatter	1.1	0.53%
silicified peat	1	flake	0.7	0.34%
siltstone	1	flake	0.1	0.05%
SRC	1	core frag.	11.1	5.35%
SRC	45	flake	53	25.06%
SRC	16	shatter	71.8	34.60%
white chalcedony	4	flake	1	0.05%
Total	176		207.5	99.05%

Table 6.2: Table indicating relative abundance of lithic material types according to debitage associated with cultural level five. Percentages are calculated by weight.

6.6.2 Cultural Level Five Faunal Remains

6.6.2.1 Identified Faunal Remains:

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison*

MNI = 2, NISP = 64.

(See Table 6.3 for elements).

Anatomical Portion	Element	Right	Left	Indt Side or Axial	Burned	Unburned	Total No. Identified Fragments	Weight (g)
Cranium:	mandible	2	1	9		12	12	307.8
	lower 3rd molar		1			1	1	44.7
	incisor		2			2	2	8.8
	upper molar		1			1	1	20.3
Vertebrae	cervical			3		3	3	32.5
	lumbar			1		1	1	6.4
	indt. vert.			2		2	2	6.4
Ribs:	rib			1		1	1	3.8
Forelimb:	scapula			1		1	1	33.8
	humerus	2	1	1	1	3	4	273.8
	ulna	1	4		1	4	5	87.6
	radius	3	1	1		5	5	270.6
	internal carpal	1			1		1	19.8
	unciform carpal	1	1		2		2	20.5
	metacarpal		1				1	91.1
Hindlimb:	tibia		2			2	2	210
	femur	1			1		1	6.3
	fused 2nd/3rd	1			1		1	8.2
	calcaneus	1	1		1	1	2	77.5
	fused cent/4th	2				2	2	57.8
	lateral malleolus		1			1	1	6.9
	metatarsal	1	1	1		3	3	101.7
Phalanges:	1st phalanx			2		2	2	29.5
	2nd phalanx			3	2	1	3	34.9
	3rd phalanx			1		1	1	35.7
Miscellaneous:	metapodial			1	1		1	42.8
	sesamoid			2	1	1	2	5.5

Table 6.3: Table illustrating NISP (number of identified specimens) listed by element for bison in cultural level five.

Class Mammalia, Order Carnivora, Family Canidae, *Canis* sp.

MNI = 1, NISP = 2.

Remains include one atlas vertebrae (3.9 g.) and one burned canine tooth (0.4 g.).

Class Mammalia, Order Rodentia, Family Sciuridae, *Marmota monax*

(Woodchuck, Ground Hog)

MNI = 1, NISP = 1.

Remains include one burned cervical vertebra fragment (0.2 g.).

Class Mammalia, Order Rodentia, Family Cricetidae, Subfamily Cricetinae,

Peromyscus sp. (Deer Mouse)

MNI = 1

Remains include one unburned right mandible.

Class Mammalia, Order Rodentia, Family Cricetidae, Subfamily Arvicolinae

(vole)

Remains include five unburned molars.

Class Mammalia, Order Rodentia, Family Cricetidae, Subfamily Arvicolinae, *Clethrionomys gapperi.* (Gapper's Red-Backed Vole)

MNI = 1

Remains include one unburned upper right third molar and one nearly complete cranium and mandible.

Class Mammalia, Order Rodentia, Family Cricetidae, Indeterminate genus.

(mice and voles)

Remains include one unburned upper incisor.

Class Amphibia, Order Anura, Family Ranidae, *Rana pipiens* (Leopard Frog based on size). MNI = 1, NISP = 1.
Remains include one burned urostyle fragment (0.1 g.).

Class Aves, Order Anseriformes, Family Anseridae, *Mergus* cf.*merganser* (Common Merganser) or *M.* cf. *serrator* (Red-Breasted Merganser).
MNI = 1, NISP = 1.
Remains include one first phalanx of the right forelimb (0.2 g.).

6.6.3 Cultural Level Five Discussion

Level five contains a small but diverse faunal assemblage which hints at the dietary possibilities exploited during the Middle Plains Precontact Period. Although bison meat undoubtedly made up the bulk of the protein and fat ingested by the inhabitants of the site at this time, the presence of burned *Marmota monax* remains may indicate that these large, slow moving rodents were also utilized as food. Banfield (1987: 107-108) notes that 'woodchucks' are among the easiest animals in Canada to catch. Furthermore, members of the species can weigh up to 6.0 kg and may have large reserves of subcutaneous fat during late summer and early fall months, possibly making the animals an attractive, opportunistic food source. Indeed, *Marmota monax* is included, along with gopher and chipmunk, on a list of animals thought fit to eat by the Plains Cree (Mandelbaum 1979: 70). Small rodents such as mice and voles may have been used as supplementary sources of meat, but this is impossible to prove based on the evidence from level five. The Anura (frog) remains are of interest in that they are burned. Frog remains were also recovered during the original 1956 excavation but, unfortunately, those particular specimens have disappeared. The museum specimen was described as a partial skeleton (Nero and McCorquodale 1959: 88) implying that several elements were recovered. No data is available on whether or not the specimen was burned. In addition, a virtually complete unburned frog skeleton was recovered from a test trench excavated south of the main block in 1996. The completeness of that skeleton along with the absence of any form of bone modification indicates that the specimen most likely represents an individual that died in its hibernaculum (Morlan 1994b: 138), a phenomenon which may account for the presence of the museum "partial skeleton" (Nero and McCorquodale 1958). However, as with the burned microtine rodent remains in other levels, one can not readily discount the idea that the burned frog remains from level five may represent food. Frog remains appear to be more commonplace at sites in the Central and Southern Plains during the Late Precontact Plains Period (Bozell 1991, Drass and Flynn 1990), but their exact relationship to the human occupants is apparently poorly understood and seldom, if ever, discussed in literature. Grinnell (1972: v. II: 135) notes the power of the frog, as a symbol among the Cheyenne, and describes its image on a drinking vessel that belonged to a powerful Cheyenne medicine man. The symbol along with likenesses of various other water creatures gave certain medicines increased potency. One unburned first phalanx identified as *Mergus merganser* or *M. serrator* is the only avian element positively identified to genus represented in the entire cultural sequence at DhMn-1. The relative fragility of pneumatic bird bones compared with more dense mammalian, amphibian and reptilian elements may help explain the paucity of an entire class of animals in the assemblage. It should be noted that several small unidentified long bone shaft fragments and a burned cranial fragment could be avian. Mandelbaum (1979: 69-70) lists many species of waterfowl, including ducks, teals, and geese, among the birds eaten by the Plains Cree. Canid remains are limited to just 2 elements in this assemblage. Such remains are commonplace in Middle Plains Precontact Period archaeological assemblages throughout the Northern Plains. McKean Complex assemblages at the Cactus Flower Site in Southeastern Alberta (Brumley 1975: 80) contained the remains of at least five canids with several elements demonstrating signs of butchering, evidence that canids were regarded as an acceptable food source during that period. Bison elements indicate that a minimum of two individuals were processed at the site during this occupation. The MNI was based on distal left tibii, distal left humerii, and right fused central and fourth tarsals. Statistically, only 6.99% (166.2 g.) of the identified bison elements are burned or charred. In contrast, 93.01% (2212.5 g.) of the bison elements are unburned including an articulated right forelimb joint consisting of a distal humerus, a proximal radius and ulna. It should be noted that the shafts of the elements were smashed off in a manner consistent with Binford's (1981: 157) descriptions of marrow extraction from articulated limb elements which have been stripped of meat. In such instances, first the meat is stripped, then the articulated limb is placed across some form of anvil at which time the shafts of the marrow-filled long bones are struck with a hard implement and smashed open to extract the marrow plug.

6.6.4 *Level Five Summary*

Cultural level five has been attributed to the McKean/Duncan/ Hanna complex of the Middle Middle Precontact Period based on the recovery of a Hanna projectile point base fragment. The level also includes a projectile point tip, a preform, a biface fragment and an endscraper. All of the tools are made of materials which appear as debitage, including Swan River Chert, Knife River Flint and jasper, suggesting that tools were manufactured or repaired at the site.

The faunal assemblage is small, but diverse, including bison, canid, woodchuck, merganser, frog, and microrodent remains. Bison represent the main source of protein and fat during this occupation, comprising 99.5 % of all identified bone, with the remains of woodchuck (*Marmota monax*), canid (*Canis sp.*), Common Merganser (*Mergus merganser*) or Red-Breasted Merganser (*M. serrator*), and possibly even frogs (*Anura*) as supplemental sources.

6.7 Cultural Level Six

Cultural level six has been assigned to the Oxbow complex based on the presence of basally-concave, side-notched projectile points and a single radiocarbon date (S-3648 cal: 2 sigma 4513 [4277] 3994 BP). The level may have been partially degraded by episodic floods but artifacts associated with it appear to be stratigraphically isolated and the problems of mixing evident in cultural levels four and five are not of concern here.

6.7.1 Cultural Level Six Lithics

Metric analysis of formed tools is presented in Table 6.4. Very few complete items were recovered so, in some instances, extrapolated lengths were calculated along with actual artifact dimensions. Projectile points are illustrated in Plate 6.2 although a conjoining fragment of one point (Plate 6.2: B) was recovered from debitage after the photograph had been prepared. This point and it's tip are also illustrated in Plate 4.2: (chapter four) shown in comparison with projectile points from level 8 at the Long Creek site which were instrumental in defining the Oxbow complex (Wettlaufer and Mayer-Oakes 1960). Large bifaces from the site are shown in Plate 6.3. The irregular shapes associated with retouched flake tools makes metric analysis impractical as such results may be difficult to reproduce. Many of these tools are illustrated in Plate 6.4.

6.7.1.1 Projectile Points:

Cultural level six is associated with fragments of six projectile points of which five are complete enough to be stylistically assigned to Oxbow complex. These points all exhibit shallow side-notches located relatively high on the lateral edges and a deep concave base which combine to give the points the characteristic 'eared' or 'lugged' appearance. All of the points exhibit basal thinning flake scars projecting upward from the concave portion of the base. Two of the points (artifacts #3302 and 2795) are fractured longitudinally, a breakage pattern that appears frequently among Oxbow assemblages and may have resulted from direct impact at the tip in combination with the inertia of the attached shaft instantaneously

Tool Type	Percentage Complete	Catalogue Number	Maximum Length (mm)	Extrapolated Length (mm)	Maximum Width (mm)	Maximum Thickness (mm)	Weight (g)	Material type
Projectile Points:	99%	1257+989	48*	49	24.6	6	5.8	SRC
	75%	2795	40	40	15.8*	5.3	3.6	SRC
	85%	3207	25*	34	20	5.6	2.8	SRC
	45%	3302	32.3*	34-40	10.2*	6	1.7	SRC
Preform:	100%	483	36	36	22	8.8	6.8	SRC
Bifaces:	50%	2227	44*	45	21.2*	9.2	7.8	SRC
	75%	3193	40.5*	42	31.3	10.6	12.4	SRC
	90-100%	1254	41*	50	33.6	10.7	16.4	SRC
Unifacial Knife:	70%	199	47*	N/A	26	4	6.2	SRC
Concave Scraper:	90%	1728	29.2	29.2	22.2	4.3	2.7	KRF
Endscrapers:	100%	1256	16	16	14.8	5.8	1.3	SRC
	100%	983	20.6	20.6	18.5	7	2.6	FS
Side-Endscraper:	100%	2611	51.6	51.6	30	8.2	12.9	SRC

Table 6.4: Metric analysis of lithic tools from cultural level six.
* Denotes measurement incomplete portion due to breakage.

transferring energy through the concave base, probably influenced further by the hafting technique. This is speculative, but may hypothetically work on similar principles to those that govern bipolar pebble splitting technology. Artifact number 2795 (Plate 6.2: C) is made from heat-treated Swan River Chert and is biconvex in longitudinal cross section and transverse cross section. This point has slightly convex lateral margins and the tip, though partially broken, appears to have been sharpened to form a nipple-like point. The point was completely shaped by soft hammer percussion and pressure flaking. The 'ears' of this particular point are rounded and the side-notches appear to have been ground slightly. Artifact number 3302 (Plate 6.2: E) is also made from heat-treated Swan River Chert with a shallow side-notch that was subsequently ground. The base is relatively deep and the juncture of basal and lateral margins result in an angular lug shape. The longitudinal and transverse cross sections are

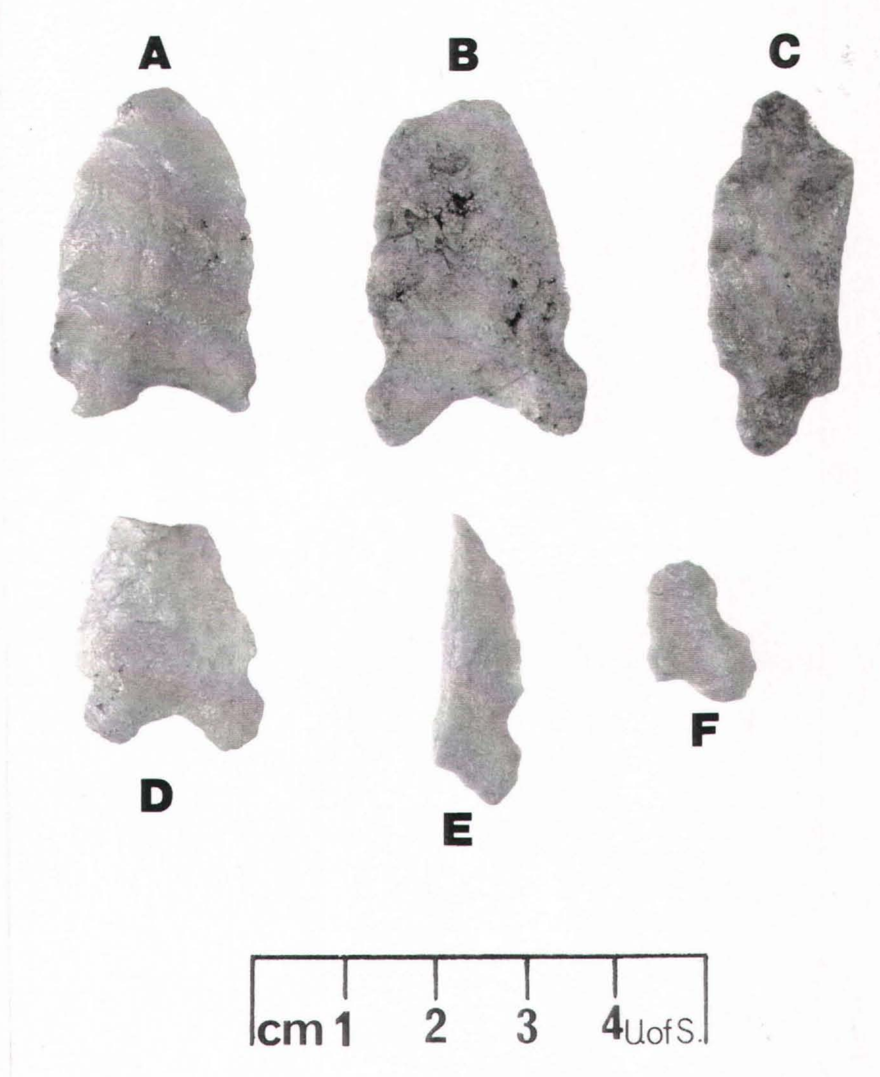


Plate 6.2: Projectile points and preform from the cultural level six. A: SRC projectile point preform (#483), B: SRC Oxbow projectile point (#1257: the tip of this point is illustrated in Plate 4.2: H), C: SRC Oxbow projectile point (#2795), D: SRC Oxbow projectile point (#3207), E: SRC Oxbow projectile point (#3302), F: SRC Oxbow projectile point base fragment (#2566).

biconvex. One essentially complete basally concave, side-notched projectile point was recovered in two pieces (Artifact body # 1257 and tip # 989) from two adjacent units (body: 98N 31E and tip: 97N 31E). This point is made from poor quality, heat-treated Swan River Chert (Plate 6.2: B and Plate 4.2: H). The point has several vugs which would have greatly weakened its structure. The tip appears to have broken off at one such vug. The overall shape is symmetrical and triangular with slightly convex lateral margins with shallow side-notches located high along the lateral margins. The notches appear to have been ground as a final preparation for hafting. The junctures of the basal and lateral margins result in angular lugs on either side of the base. The transverse cross section is biconvex but the longitudinal cross section is convex/concave. Artifact number 3207 (Plate 6.2: D) is an asymmetrical Swan River Chert basally concave side-notched projectile point recovered from unit 101N 29E. The asymmetry may be the result of resharpening. The notches on this point are slightly more angular than those described for other Oxbow points in the assemblage with the result that this artifact has a shouldered appearance. Once again, the notches show evidence of grinding. The lateral margins are straight but their juncture with the concave basal margin creates lugs with a rounded appearance. The transverse and longitudinal cross sections of this point are biconvex. The tip of the point is missing and appears to have broken off at a vug. Artifact number 2566 (Plate 6.2: F) is a small fragment of a heat-treated Swan River Chert Oxbow point base recovered from unit 97N 30E. The fragment represents the lateral basal portion, roughly equivalent to a single lug. A small portion of projectile point recovered in unit 98N 31E is represented by artifact number 1252 (not illustrated). The artifact can not be assigned to any projectile point style but the material (Swan River Chert) closely resembles that used for the other points. The transverse cross section of this item is biconvex.

6.7.1.2 *Preforms:*

Artifact number 483 (Plate 6.2: A) is a point preform recovered from unit 100N 30E. This item is made from heat-treated Swan River Chert and contains numerous vugs. The tip appears to have been unfinished. The maker may have given up on the project when they were unable to successfully reduce its thickness. Generally, the preform is biconvex in transverse cross section but step fractures appear to have created a thick mass of material near the basal portion which would have made hafting difficult. The preform has convex lateral margins and a concave base but only rudimentary side-notches.

6.7.1.3 *Hafted Bifaces:*

Artifact number 2227 (Plate 6.3: C) represents a class of lithic tools referred to as hafted bifaces. It is unclear as to whether these items served as knives hafted to short handles or spear points fastened to long shafts or foreshafts. Artifact number 2227 is large concave-based, side-notched triangular biface similar to an Oxbow atlatl dart tip but much larger. This item was recovered from unit 102N 29E from a flintknapping workshop area which covered several units, where projectile points 2795 and 3207 were also recovered. The artifact is made of relatively high quality heat-treated Swan River Chert. Although this item is quite thick (9.2 mm), large basal thinning flakes were removed from the concave base. As with smaller projectile points, the side-notches are pressure-flaked high on the lateral margin and subsequently ground to reduce the chance of cutting through the hafting material. The lateral edge is straight. The longitudinal

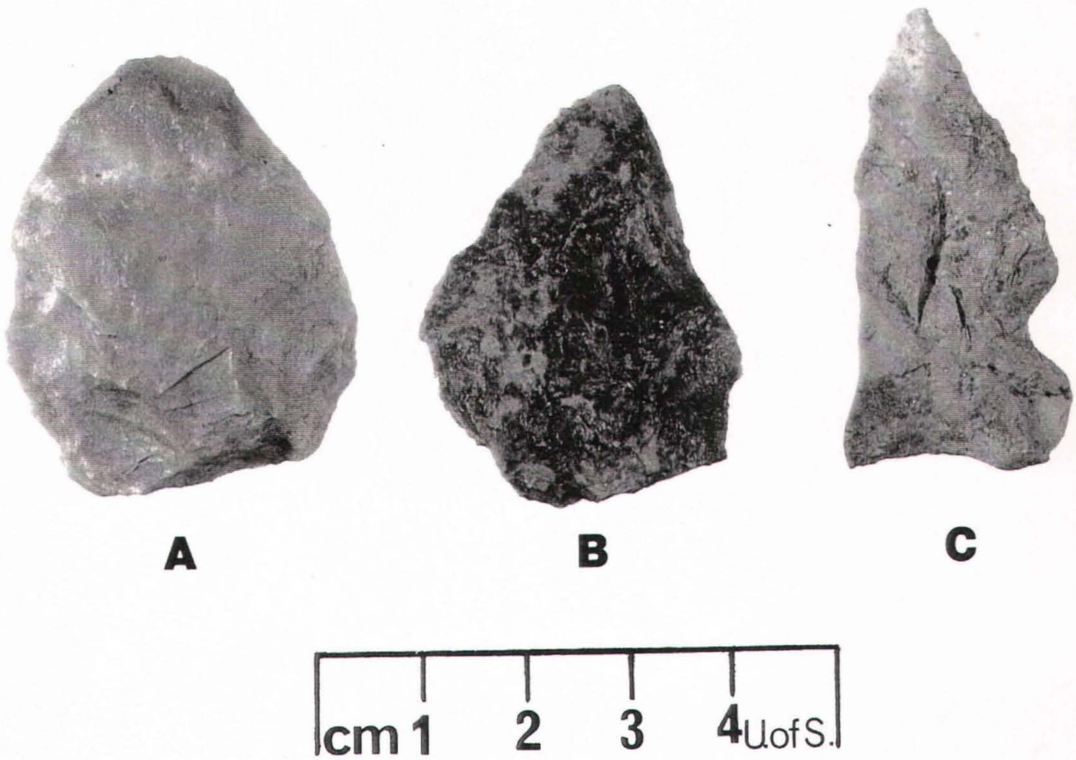


Plate 6.3: Large Bifaces from cultural level six at DhMn-1. A: banded SRC biface (#1254), B: orange and black chert biface (#3193: hafted?), C: SRC hafted biface (#2227).

and transverse cross section is biconvex. This biface is fractured longitudinally similar to the common fracture pattern exhibited by Oxbow projectile points. If the projectile point fractures are caused by impact, then a similar cause may be responsible for splitting this biface. If that was the case, the object was likely used as a spear point rather than a short-handled knife. Artifact number 3193 (Plate 6.3: B) is another large, triangular biface that appears to have been side-notched and likely concave-based but the lugs have been broken off. The artifact is made from a dark grey and orange-flecked chert with vugs. Although the lugs have been broken off, the center of the basal concavity is still relatively intact and shows evidence for the removal of thinning flakes. The lateral margins are concave, possibly resulting from resharpening or attempting to thin the object. Again, both the transverse and longitudinal cross sections are biconvex.

6.7.1.4 Other Bifaces:

Artifact number 1254 (Plate 6.3: A) is an ovoid biface made of banded Swan River Chert recovered from unit 98N 31E. The artifact appears to have been completely shaped by percussion flaking and the waxy lustre of the chert suggests that it was heat-treated. One end of this item appears to have been broken off, either intentionally to produce a backed knife or during use and subsequent attempts were made to further modify the broken edge. The longitudinal cross section is biplanar but the working edge is undulating. The transverse cross section is irregular. A tip of a second similar artifact is number 1004 (not illustrated), recovered from unit 97N 31E. This object is made from the same heat treated, banded Swan River Chert as artifact number 1254. Artifact number 3120 (not illustrated) is a relatively thick, diamond-shaped biface made of heat-treated Swan River Chert. The tool is crudely made, but is easily held in the hand and was likely used as a butchering tool. It was recovered from unit 101N 29E. Three fragments of other bifaces were also recovered from the Oxbow component. These include one quartz biface fragment from unit 98N 29E (not illustrated), one Knife River Flint biface fragment from unit 96N 30E (not illustrated), and one Swan River Chert biface fragment from unit 98N 28E (not illustrated). All three of these tools appear to be reasonably well-made but the fragments are too small to determine their completed shape or possible function. One bifacial flake tool or expediency tool (artifact # 1646) was recovered from unit 100N 30E. This type of tool is, essentially, a very effective cutting tool which combines the sharpness of a flake with the durability of a retouched stone edge (Plate 6.4: K). The tool is made from heat-treated Swan River Chert.

Another class of bifacial tools is represented by artifact number 3242. The tool is very small with an arched working edge, similar to a modern woodworker's gouge (Plate 6.4: H). This example is made from Fused Shale and appears to have been made by retouching the bulb of percussion of a larger flake, essentially hollowing it out. The working edge shows a small amount of polish; however, this lithic material is relatively soft, with a hardness rating of 6-7 (Johnson 1986: 90) when compared with Swan River Chert, with a rating of 7 (Johnson 1986:68). Johnson (1986:89) notes that Fused Shale is more commonly used for projectile points than for tools used for cutting and scraping. It may be that this small tool was used on soft materials (ie: to remove small pieces of cooked meat from bone, or to strip bark from small tree limbs).

6.7.1.5 Unifacial Knives:

Artifact number 199 is a very thin (4 mm) unifacially retouched knife, from unit 103N 28E, made on a carefully prepared flake of heat-treated Swan River Chert (not illustrated). Dorsal ridges run down the upper surface of the tool while the ventral surface is slightly twisted but primarily flat. The item features convex working edges and a biplanar longitudinal cross section. The transverse cross section is slightly

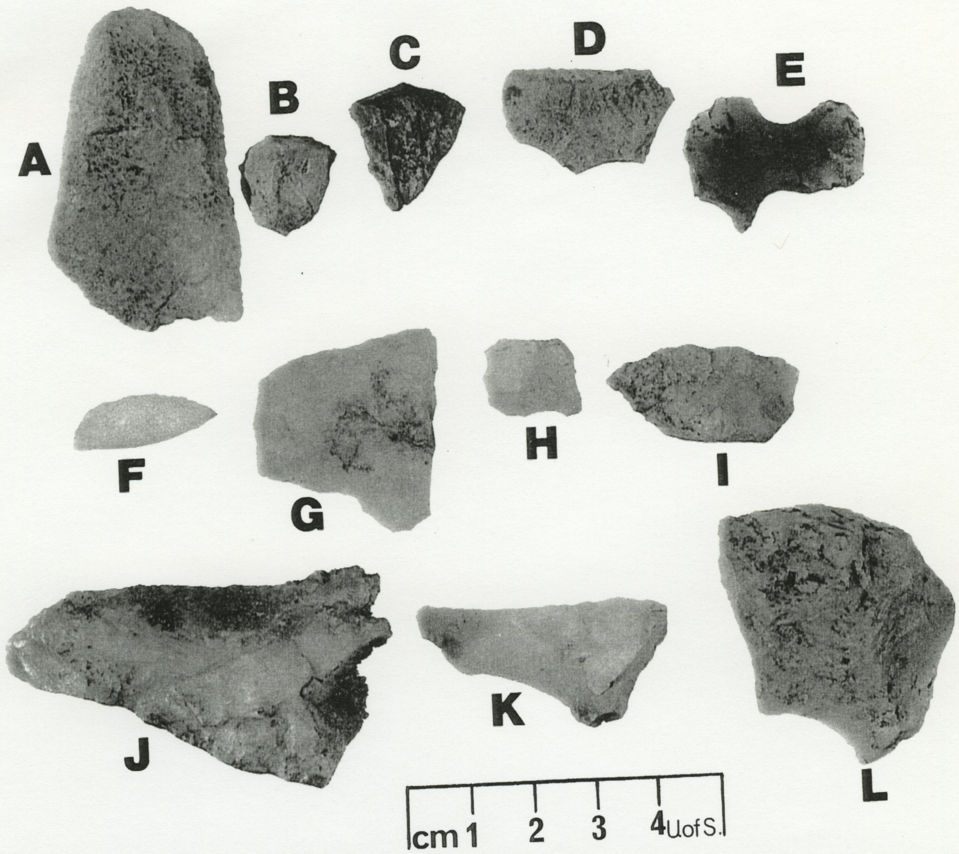


Plate 6.4: Assorted scrapers and flake tools from cultural level six. A: SRC end/ sidescraper(#2611), B: SRC endscraper (#1256), C: silicified wood endscraper (#983), D: SRC unifacial flake tool (#1258), E: KRF concave scraper "spokeshave" (#1728), F: SRC unifacial flake tool (#2794), G: SRC unifacial flake tool (#2379), H: fused shale gouge (#3242), I: SRC flake tool (1253), J: SRC unifacial flake tool (#1413), K: SRC bifacially retouched flake tool (#1646), L: SRC scraper made on large flake (#1255).

convex/planar. It appears to have been notched and hafted, although a portion of the base is missing.

6.7.1.6 Endscrapers, and Sidescrapers:

Cultural level six contains four artifacts which fall into the category of specially prepared unifacial scraping tools. Artifact number 2611 is an end/sidescraper recovered from unit 97N 30E and made of heat-treated Swan River Chert (Plate 6.4: A). This item is very similar in size, material and manufacturing style to artifact number 199 described above. The scraper is made from a prepared flake with two dorsal ridges running its entire length on the upper surface and a large bulb of percussion on the proximal end of the ventral surface. The right lateral edge is retouched to produce a straight to slightly convex sidescraper which continues into a convex scraping edge at the distal end. Only a minimal amount of retouch has been performed on the left lateral margin. Artifact number 1256 is a form of small endscraper often referred to as a 'thumbnail' scraper (Plate 6.4: B). These tools are generally triangular in shape with slightly irregular convex lateral edges and a meticulously regular convex distal working edge. In transverse cross section, the dorsal surface is domed while the ventral surface is usually very flat. In longitudinal cross section, they tend to be slightly wedge-shaped with the thickest portion at the distal working edge. The working edge is often very steeply beveled at between 60 and 80 degrees. This particular example is made from heat-treated Swan River Chert which is identical to the material used for artifact number 2227, a large hafted biface. Artifact number 983 was recovered from unit 97N31E and is another example of a small end scraper (Plate 6.4: C). This artifact is made of silicified wood but is morphologically similar to the aforementioned endscraper, with the exception that the ventral surface of 983 is convex in transverse cross section rather than flat.

6.7.1.7 Concave Scrapers:

Concave scrapers are a unique form of specialized tool frequently associated with woodworking activities such as bark stripping and arrow or atlatl dart shaft scraping. Hence, these tools are commonly referred to as 'spokeshaves'. This term is rather misleading in that it implies the use of such tools in wheel production and, therefore, the term 'concave scraper' more accurately describes these tools without suggestive connotations and is used here. One general characteristic of this form of tool is the presence of a unifacially-prepared, steeply-beveled concave working edge. Otherwise they vary greatly in size, shape, and manufacturing technique. One concave scraper was recovered from the Oxbow component in unit 97N 29E. Artifact number 1728 is made on a flake of high-quality Knife River Flint (Plate 6.4: E). This particular example is broken but it appears originally to have had three concave working edges, two of which are separated by a remnant spike of material suitable for use as a perforator or graver. All of the concave working edges show signs of use. As with sidescrapers and endscrapers, the ventral surface is flat while the dorsal surface is convex.

6.7.1.8 Unifacially Retouched Flake Tools:

Nine tools are classified as unifacially retouched flakes or unifacial expediency tools. As discussed briefly above, this class includes a variety of quickly-made cutting and scraping implements which often do not follow a specified form and retain many of the features of the flakes and other debitage from which they are derived This makes this class of tools more difficult to distinguish from discarded debitage than items such as endscrapers, sidescrapers and projectile points which have a more 'finished' appearance. Artifact number 1255 is large heat-treated Swan River Chert uniface from unit 98N 31E. This artifact (Plate 6.4: L) is made from a thick flake and resembles a large, crude endscraper with a convex, beveled working edge but is otherwise not formally shaped. Assuming that the working edge is the distal end, a bulb of percussion is visible on the left ventral surface of the tool. Artifact number 2248 (not illustrated) is an irregularly-shaped scraper made on a thick cortical flake of Swan River Chert. The working edge is convex but angular and the ventral surface is curved laterally upward.

Three artifacts consist of thin, minimally retouched flakes of heat-treated Swan River Chert. These artifacts (number 985: not illustrated, number 1258: Plate 6.4: D and number 2794: Plate 6.4: F) may have functioned as small cutting implements and are characterized by straight to convex working edges with low-angled bevels. All of these items are less than 2 mm thick. Artifact number 2379 (Plate 6.4: G) is a larger version made on a more robust Swan River Chert flake. The working edge is essentially the same; however, the flake is over 7 mm thick. Three other artifacts (336: not illustrated, 1253: Plate 6.4: I, and 1413: Plate 6.4: J) are flake tools with irregular working edges. Artifact number 1413 is a large curved Swan River Chert flake with visible cortex and a working edge which is straight in planview but considerably arched when viewed on edge. Similarly, artifact number 1253 is a small flake tool with a straight, but arched, working edge. Artifact number 338 is a fragment of a large unifacial chopping tool made on a thick heat-treated Swan River Chert flake.

6.7.1.9 *Debitage:*

Analysis of debitage (Table 6.5) indicates that Swan River Chert was used extensively for tool production during this occupation. A total of 95.8% of all of debitage, including flakes, shatter and expended core fragments, is Swan River Chert. The balance is a combination of quartzite, fused shale, jasper, and various cherts, and chalcedonies.

6.7.1.10 *Fire-Cracked Rock:*

Level six contains the largest amount of FCR of any of the cultural levels at DhMn-1. A total of 34.75 kg of FCR was recovered, much of which came from an area toward the northwestern corner of the excavation block associated with lithic debitage and broken tools. The FCR may have been cleaned out of features such as boiling pits (although none were noted from this level) and dumped into this refuse area.

6.7.2 *Cultural Level Six Faunal Remains*

6.7.2.1 *Identified Faunal Remains:*

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison*
MNI = 3, NISP = 112.
This MNI is based on mature left ulnar carpals and left tibii, and the presence of a juvenile proximal metapodial.
(See Table 6.6 and Figure 6.1 for elements represented)

Material	Count	Description	Weight(g)	Percentage
SRC	11668	flake	4947.4	72.96%
SRC	67	shatter	727.3	10.73%
SRC	10	core	821.4	12.11%
fused shale	9	shatter	1.6	0.02%
indeterminate chert	8	flake	8	0.12%
petrified wood	2	shatter	6.6	0.10%
jasper	4	flake	0.6	0.01%
KRF	16	flake	5.4	0.08%
KRF	1	shatter	0.5	0.01%
quartzite	107	flake	235.9	3.48%
quartzite	2	shatter	1.2	0.02%
quartz	2	shatter	18.7	0.28%
white chalcedony	3	flake	0.8	0.01%
pebble chert	2	shatter	2	0.03%
silicified peat	1	flake	0.4	0.01%
siltstone	6	flake	2.5	0.04%
TOTAL	11908		6780.8	100.01%

Table 6.5: Table indicating relative abundance of material types according to lithic debitage associated with cultural level six. Percentages are calculated by weight.

Class Mammalia, Order Artiodactyla, Family Antilocapridae, Antilocapra americana. MNI = 1. NISP = 1.

Remains include: one burned olecranon process of a left ulna.

Class Mammalia, Order Carnivora, Family Canidae, *Canis* sp.

MNI = 2 large canids, MNI = 1 medium canid, MNI = 1 small canid, NISP = 113.

(See Table 6.7 and Figure 6.2 for elements represented)

Class Mammalia, Order Rodentia, Family Sciuridae, *Spermophilus richardsoni* (Richardson's Ground Squirrel)

MNI = 1, NISP = 1.

Remains include one unburned right mandible (0.3 g).

Anatomical Portion	Element	Right	Left	Indt Side or Axial	Burned	Unburned	Total No. Identified Fragments
Cranium	petrous portion	1		1	2		2
	premaxilla		1			1	1
	mandible		1		1		1
	incisor teeth			3		3	3
Vertebrae	atlas			2		2	2
	cervical			8		8	8
	thoracic			4	2	2	4
	lumbar			5	1	4	5
	indt.			2	1	1	2
Ribs	rib			7	5	2	7
Forelimb	scapula	2	1	2	2	3	5
	humerus		1		1		1
	radius	5	2	5	3	9	12
	ulna	1		2		3	3
	carpals: accessary		1		1		1
	radial	1	1		2		2
	ulnar	1	2		1	2	3
	fused 2nd/3rd		1	1	2		2
	internal		2		1	1	2
	metacarpal		2			2	2
Hindlimb	femur	2	1	1		4	4
	tibia		2			2	2
	tarsals: calcaneus	4		1	1	4	5
	fused Cent/4th		4	1	4	1	5
	astragalus	2	1		1	2	3
	fused 2nd/3rd	1			1		1
Phalanges	1st phalanx			4	2	2	4
	2nd phalanx			9	5	4	9
	3rd phalanx			1	1		1
Miscellaneous	carp/tars:indt			2	2		2
	long bone:indt			1		1	1
	metapodial:indt			3	1	2	3
	sesamoid			5	5		5

Table 6.6: Table indicating the NISP for fragments of Bison elements represented in cultural level six.

The ground squirrel specimen was recovered from unit 98N 29E and may be associated with a rodent burrow from which a right femur of the same species was recovered in cultural level seven, unit 98N 28E.

Class Mammalia, Order Rodentia, Family Cricetidae, Indeterminate genus. (See Table 6.8 for elements)

Class Mammalia, Order Rodentia, Family Cricetidae, Subfamily Arvicolinae, (vole) Indeterminate genus.
Remains include: one unburned right mandible, one unburned left mandible, seven unburned molars, 18 burned molars.

Class Amphibia, Order Anura, Family indeterminate. MNI = 1, NISP = 1. Remains include one burned long bone fragment.

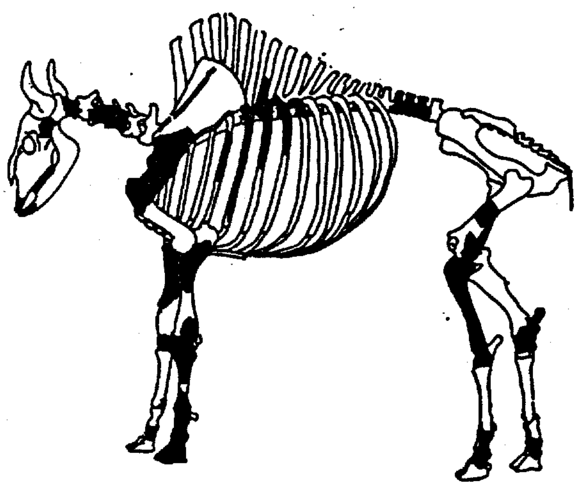


Figure 6.1: Bison elements represented in cultural level six (adapted from Gilbert 1990: 36).

Anatomical Portion	Element	Right	Left	Indt Side or Axial	Burned	Unburned	Total No. Identified Fragments
Large Canid:							
Cranium	occipital			1	1		1
	mandible		2	1		3	3
	maxilla	2			2		2
	premaxilla	1			1		1
	temporal	1			1		1
Teeth	canine			3	1	2	3
	lower 1st premolar		1	1		2	2
	lower 2/3 premolar		1			1	1
	upper premolar			1		1	1
	lower 3rd incisor	1		1		2	2
	indt incisor			3		3	3
	indt premolar			2		2	2
Vertebrae	cervical(indt)			4	1	3	4
	indeterminate			5		5	5
	lumbar			1		1	1
	atlas			6	1	5	6
	axis			4	2	2	4
Ribs	ribs			18	10	8	18
Forelimb	humerus	2	3	1	5	1	6
	radius	1	1		1	1	2
	ulna		2		2		2
	metacarpal: indt			1	1		1
Hindlimb	ischium	1	2		3		2
	illium		1		1		
	pubis		1		1		
	femur	2	3	3	6	2	8
	tibia	2	1			3	3
	fibula			1		1	
	tarsal: indt			1		1	1
	metatarsal			1	1		1
Miscellaneous	long bone: indt			2	1	1	2
	metapodial			8	8		8
	phalanx: indt			6	3	3	6
	sesamoid			4	3	1	4
Canis familiaris?	mandible	1	1			2	2
Medium Canid:	femur	1			1		1
	mandible	1	1	1		3	3
Small Canid:	metatarsal			1		1	1

Table 6.7: Table indicating the NISP for fragments of Canid elements represented in cultural level six.

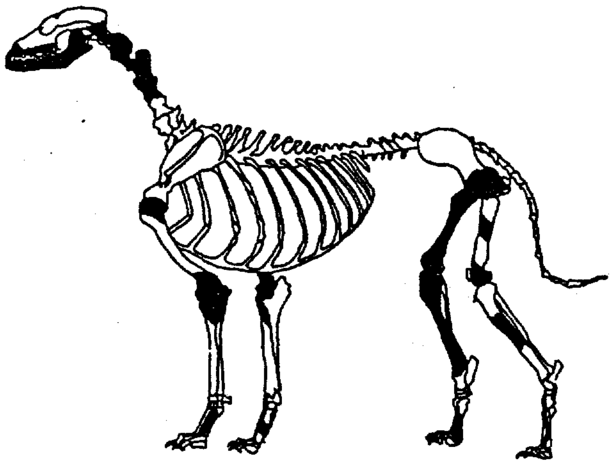


Figure 6.2: Canid elements represented in cultural level six (adapted from Gilbert 1990: 35).

Anatomical Portion	Element	Right	Left	Indt Side or Axial	Burned	Unburned	Total No. of Identified Fragments
Cranium	incisor			9	5	4	9
	upper incisor			3	3		3
	mandible	1				1	1
Vertebrae	atlas vertebrae			2		2	2
Forelimb	humerus	1		4	2	3	5
Hindlimb	femur	2	2	2	2	4	6
	calcaneus			3		3	3
	astragulus			2	1	1	2

Table 6.8: Table indicating the NISP for fragments of Cricetid elements recovered from fine-screen samples from in cultural level six.

Class Mammalia, Order Lagomorpha, Family Leporidae, cf. *Sylvilagus* sp. (cottontail)

MNI = 1. NISP = 1.

Remains include one unburned distal left tibia.

Class Reptilia, Family Testudinidae, Subfamily Emydinae, *Chrysemys picta belli.* (Western Painted Turtle)

MNI = 1. NISP = 8.

Remains include one burned corocoid with cutmarks (0.3 g), one burned marginal plate of carapace with cutmarks (0.5 g), one burned left forelimb marginal process of carapace (0.2 g), one burned cervical vertebrae fragment (0.2 g), one burned right distal fibula (0.1 g), one burned right proximal humerus (0.2 g), one burned left distal radius (0.1 g), and one unburned innominate fragment (0.1 g).

Class Reptilia, Order Squamata, Family Colubridae, cf. *Thamnophis* sp. (non-venomous snake)

Remains include one unburned rib (0.1 g) and 14 burned vertebrae (1.1 g)

6.7.3 Cultural Level Six Features

Cultural level six contained a concentration of lithic debitage, broken tools, and fire-cracked rock that was mainly spread across five units in the northwest corner of the excavation. Units 101N 29E, 102N 29E, 102N 28E, 103N 29E and 103N 28E all contained large amounts of Swan River Chert detritus. In all, these units contained over 5,000 pieces of debitage (Table 6.5). Broken tools associated with this feature include two hafted bifaces

(Art. #2227, and #3193), two projectile points (#3207 and #2795), and one unifacial knife (#199). As mentioned above, the bulk of the FCR recovered from this level was associated with this feature. It may be that the area began as flintknapping workshop and later became a refuse dump for FCR and bone.

6.7.4 Cultural Level Six Discussion

The faunal assemblage in cultural level six contains a variety of different species including bison, three size ranges of canids, turtle, snake, pronghorn, cottontail, and several types of microrodents. Not surprisingly, bison represents the largest percentage of identified bone by weight in level six comprising 91.6%, followed by the canids at 7.9% with the remaining 0.5% being divided amongst turtle, snake, pronghorn, cottontail and micromammals. Species represented by small percentages are not necessarily culturally insignificant and may represent alternative or supplemental food sources. The remains of *Chrysemys picta belli* (Western Painted Turtle) are unique within the province, outside of a burial context, and will be discussed thoroughly as a possible food source.

A total of 13, 590 grams of bone (including identified and unidentified) were analyzed from level six, of which 33.3 % was burned. Nearly 75% of the total amount of bone by weight is classed as unidentifiable, almost exclusively consisting of small pulverized fragments. Of the unidentifiable remains, the percentage of burned bone increases somewhat to about 38.8 %. Cutmarks were noted on fifteen of the specimens, only three of which were identifiable to the genus level.

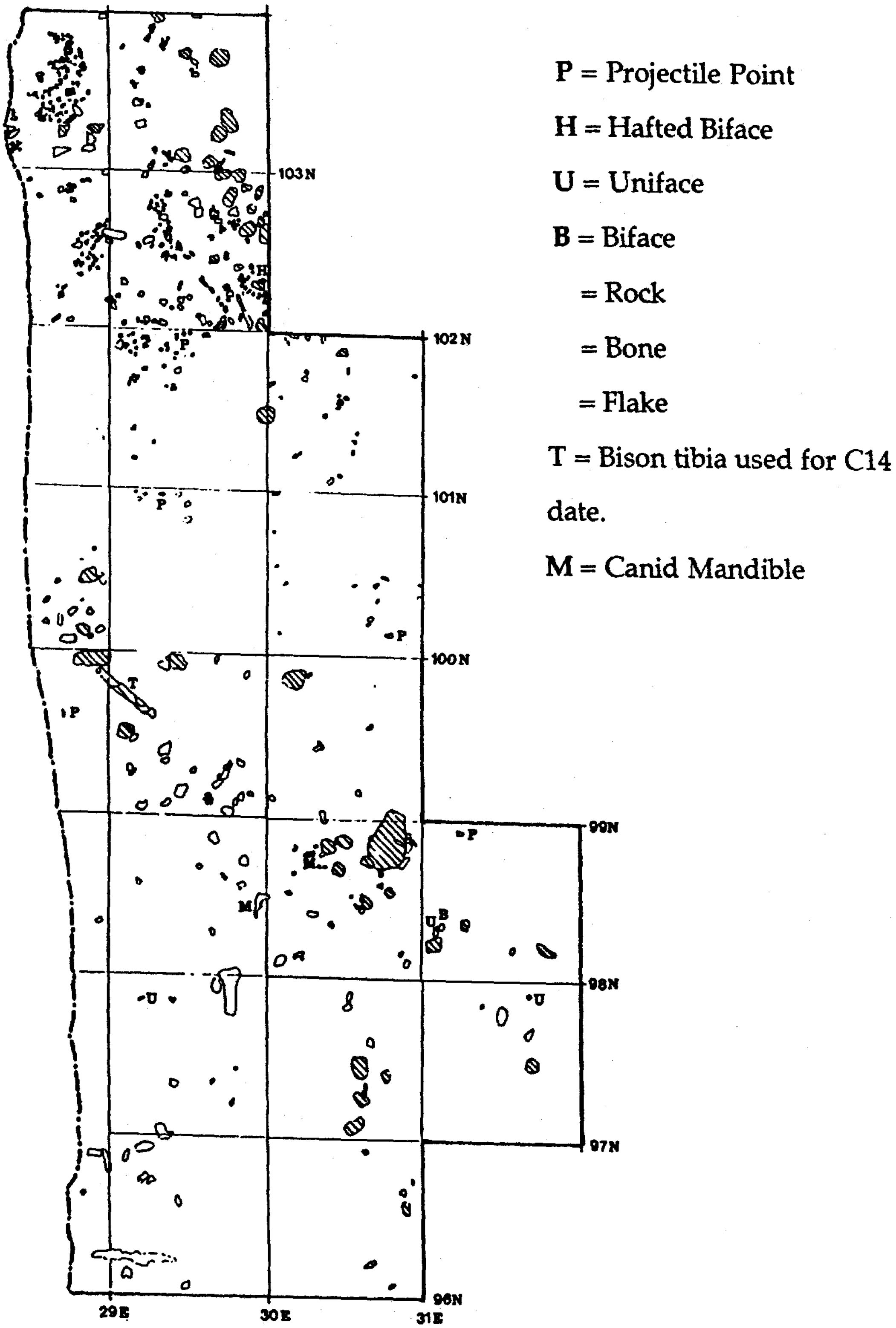


Figure 6.3: Planview of cultural level six. Note lithic concentration at north end. Also note location of radiocarbon dated tibia in relation to diagnostic artifacts.

These include an unburned canid (*Canis* sp.) long bone shaft fragment, a burned marginal plate of a turtle carapace (*Chrysemys picta belli*), and a burned corocoid of *Chrysemys picta belli*.

The bison elements in level six represent a minimum of three individuals, based on two mature left ulnar carpals and two left tibii, and a juvenile proximal metapodial fragment (see Table 6.6 and Figure 6.1). The relative lack of vertebral and cranial elements suggests that the limbs were removed from bison carcasses at some other location and subsequently transported to the site. As in the later levels at DhMn-1, which are discussed above, the fragmented state of the limb elements is indicative of marrow and grease extraction (Binford 1981). A high percentage of the identified specimens of bison bone (42.9 %) has been burned. Striking similarities exist between the bison assemblage from level six at DhMn-1 and material from the Harder site (Dyck 1977, Morlan 1994a), another Oxbow complex site located in south-central Saskatchewan. Morlan (1994a) notes a significantly small percentage of cutmarked bison bone within the Harder assemblage while no elements exhibiting cutmarks from the Oxbow Dam site were conclusively assignable to bison. The scarcity of identified humerii fragments at DhMn-1 may indicate that they were completely pulverized to extract the grease from the ends of these bones as reported by Binford (1981: 166, see also Brink and Dawe 1989, and Walker 1992). Conversely, for the Harder site assemblage, Morlan (1994a) has suggested the possibility of the destruction of long bone ends due to meat boiling and soup preparation or carnivore activity. Of interest is the low percentage of third phalanges present in relation to first and second phalanges. This scenario was also noted by Dyck (1977: 38-39, see also Morlan 1994a: 764) at the Harder site, though no explanation was presented. It may be that the absence of the these elements indicates their removal for some other form of processing or that the hooves were selectively eliminated from the assemblage by carnivores seeking out the gelatinous digital cushion which exists between the outer hoof and the bone.

The remains of Western Painted Turtle are significant in that these reptiles are frequently discussed in ethnographic literature in reference to their spiritual power, as well as their use as a food source in areas to the south and east, but their limited natural range has excluded their remains from the archaeological record in all but the southeastern portion of the province. The spiritual significance of the turtle has been fairly well documented for Plains groups both ethnographically and archaeologically. Pond (1986: 89) recounted witnessing a Dakota chief praying for good weather to a turtle figure he had made from a mound of earth. According to Lowie (1985: 147), the turtle "presided over female physiological functions" for some Dakota groups. Grinnell (1972: 193) noted that the turtle was much revered by the Cheyenne for its stealthiness, power and it's ability to move even when decapitated. The tail of a turtle when attached to a shield gave the owner considerable power including the ability to recover from serious injury. Iroquoian belief maintained that the Earth rested on the back of a giant snapping turtle (Wright 1987: Plate 15).

Within Saskatchewan, there are several depictions of turtles from archaeological sites, perhaps the most famous being the Minton Turtle Effigy located near the Big Muddy Valley in the extreme South Central part of the province. It should be noted, however, that some consider the effigy to a be a depiction of a badger rather than a turtle, based on the presence of rather prominent "ears" (Brace 1987). A more portable example, which signifies the importance of the turtle as a symbol, can be found in the assemblage from the Moose Bay Burial Mound where a clay vessel incised with four turtles was associated with human remains (Hanna 1976: 35-37). Several pieces of turtle carapace and plastron were also recovered, one of which had a hole drilled through it, while another appeared to have been worked along one edge. Likewise, several pieces of turtle carapace were recovered from a burial at Bethune (E.G. Walker, pers. com.). Several small examples of flint-knapped chert turtle amulets from within the province have been documented by the author.

Numerous ethnographic examples exist for Plains or neighbouring groups eating turtles. Samuel Pond (1984: 30) mentions that "fish and turtles were consumed in great quantities" by the Dakota of Minnesota. Lowie (1985: 17) also states that the Eastern Dakota ate turtles and fish as supplements to "meat". On the other hand, turtles and other reptiles were taboo among certain groups of Blackfoot (Ewers 1961: 87). Perhaps the most thorough documentation of Plains people eating turtles is from Grinnell (1972: 256, 307-308) who states that the Cheyenne were "very fond of turtles" as food and goes on to describe methods used for catching the reptiles. According to Grinnell, turtles were captured while in the water using a variety of methods including feeling for the animals with ones feet and holding them in position until they could be grabbed by another hunter. The hunter could distinguish between snapping turtles and other forms with his or her feet by feeling for the pronounced ridges on the snapping turtle's carapace. In light of this, turtle hunting in this manner seems like rather risky and potentially painful business. Other methods included wearing headgear made of reeds and sneaking up on unsuspecting turtles while they were floating or by creating an aquatic version of a surround where numerous people entered the water and corralled the turtles into the center where they could be captured. Alternatively, it would be as easy to walk along the shore and grab them while they sunned themselves on land.

Utilizing *Chrysemys* sp. as a food resource is certainly not limited to Native Americans. In a thorough discussion of this, and other turtle genera found in Illinois, Cahn (1937: 138) describes the flesh of *Chrysemys* sp. as being "firm and of excellent flavor" in a section dealing with the economic importance of the reptile. The common snapping turtle (*Chelydra serpintina*) is also a readily available food resource along the Souris River. Cahn (1937: 44) wrote that C. *serpentina* offered an easily obtainable source of "wholesome, nutritious meat" with a high yield (approximately half of its weight) of edible flesh. Russell and Bauer (1993: 121) also note the economic importance of the snapping turtle in eastern North America where it forms the basic ingredient in most turtle soups. While excavating at DhMn-1, the crew witnessed dozens of Western Painted Turtles and an enormous Common Snapping Turtle on at least two separate occasions. Although no measurements were taken, it is estimated that the snapping turtle's carapace was approximately 50 cm long and 35 to 40 cm wide.

Apart from burial contexts in the southeastern portion of the province, archaeological remains of turtles are rare in Saskatchewan. This is undoubtedly due to the fact that the majority of the Canadian Plains are outside the range of North American turtle species. It is possible and probable that the range has varied somewhat over time. At present, however, the burned and butchered remains from the Oxbow occupation at DhMn-1 may be the only archaeological evidence for turtle consumption with in the province. Various species become increasingly more common in archaeological site assemblages to the south and east. In a synoptic overview of subsistence variation within Plains Village sites in Oklahoma, for example, Drass and Flynn (1990: 180,181) present data indicating that, in terms of shear bone weight, turtle remains were almost double that for bison and were second only to deer at certain locations. At the Linville II Site in western Oklahoma, turtle, fish, and bird remains were interpreted as supplementary protein sources for the Plains Villagers (Drass and Moore 1987: 408). Eighmy (1970: 255-282) discusses nine pit features which each contained carapace fragments of different turtles at the Edwards II site located along the Red River in western Oklahoma. He concludes that most of the features represented Plains Village latrines and that the turtle remains represented food resources. Johnson (1987: 393) also notes turtle remains as relatively commonplace in Late Woodland and Plains Villager sites in Nebraska. Walker (1987: 329-330) describes butchered remains of *Chrysemys picta* from the Horner site, a Palaeoindian Period bison kill along the Shoshone River in northwestern Wyoming, advocating a long history for the use of turtles on the Plains, where such species exist. Based on ethnographic and archaeological data from neighbouring areas and the fact that burned limb elements and carapace fragments also showed evidence of butchering, it seems likely that the *Chrysemys picta belli* remains from the Oxbow Dam site represent a food resource.

Archaic examples of the exploitation of turtles as a food resource also come from archaeological sites in the American Midwest. Excavations at the Go-Kart North site in southwestern Illinois revealed evidence for turtle and fish procurement dating back approximately 4,000 years (Fortier 1983: 257). Jefferies and Lynch (1983: 315-321) argue for a 5,000 year old subsistence strategy developed around swamp ecosystems based on evidence from the Black Earth site, again in southwestern Illinois. Here, *Sternotherus odoratus* was the most commonly exploited turtle species. Other sources (Cahn 1937: 55) state that this variety of turtle is never eaten because the flesh has a musky taste as the common names (Musk Turtle, Stink-Pot) imply.

The most abundant remains in terms of MNI belong to *Canis* sp. (see Table 6.7 and Figure 6.2). The amount of variation within any given species of canid leads to some overlap between species and therefore size differences were utilized to class the canid remains. The MNI for various forms of canids include two large wolf-sized canids based on atlas vertebrae fragments and left humerii, one medium coyote-sized canid based on two mandibular condyles, and one small fox-sized canid based on a single metatarsal fragment. Distinguishing domestic dogs (*Canis familiaris*) from wolves (*Canis lupus*) and coyotes (*Canis latrans*) is difficult in that dogs lack the intraspecific homogeneity characteristic of wild canid species (Lawrence and Bossert 1967:225). Indeed, domestic dogs show such diversity that many characteristics show overlap with wild species. Few, if any quantitative differences exist that could be used to separate North American Indian dogs from wild canids using postcranial elements. Furthermore, many of the metric attributes used to distinguish between these species require complete or largely complete portions of crania (Lawrence and Bossert 1967), items which are seldom present in archaeological sites. A pair of mandibles from DhMn-1 show traits which are attributable to *Canis familiaris* (Plate 6.5: A and B). These mandibles are much more robust than coyote mandibles (Plate 6.5: D) but the horizontal ramus of the most complete mandible is approximately the same length. They are as robust as wolf mandibles (Plate 6.5: C) but much shorter, giving them a stout, upright appearance with a very vertically oriented ascending ramus. Dayan (1994) states that the shortening of the facial region is one of the first morphological changes to occur in the process of domestication from wolves to dogs. Morey (1992) notes that a slower rate of reduction in tooth size than maxillary and mandibular length create a crowded tooth row, as is the case with the specimens from DhMn-1. The posterior margin of the coronoid process (not illustrated) is concave, as in dogs and Chinese wolves according to Olsen and Olsen (1977), rather than straight as in the posterior margins of coronoids of wild canids. The teeth are small compared to wolf teeth, a trait characteristic of dogs and coyotes (Lawrence and Bossert 1967) but the lower carnassial tooth (first molar) exhibits an enlarged posterior lateral cusp when compared with coyotes, another dog characteristic according to Krantz (1959, as cited by Gilbert 1990: 66). Measurements of carnassial tooth length and width from the mandibles from DhMn-1 further support their designation as domestic species based on figures derived by Morlan (1994a: 762) for specimens from the Harder site and by Magee (1997: 133, 135) for individuals at the Sanderson site, both of which are located in southern Saskatchewan. The DhMn-1 figures are suggestive of a large form of domestic dog (Table 6.9).

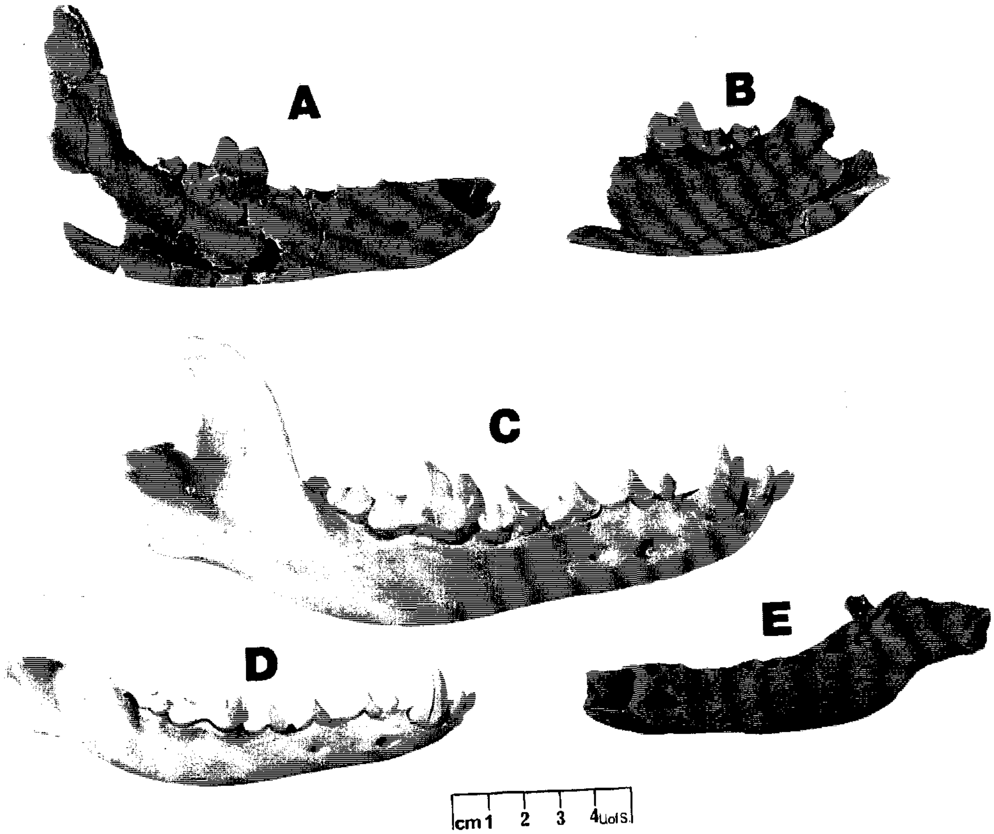


Plate 6.5: Photograph illustrating possible *Canis familiaris* (dog: A and B) from cultural level six at DhMn-1 as compared with wolf (*Canis lupus*), coyote (*Canis latrans*) and *Canis familiaris* from the Tschetter site (FbNr-1). A: right mandible from DhMn-1 (#1627), B: left mandible from DhMn-1 (#1975), C: right wolf mandible (U of S comparative collection), D: right coyote mandible (U of S comparative collection), E: suspected domestic dog from the Tschetter site (FbNr-1).

Two basic types of Plains Indian dogs, both derived from wolf stock, have been well documented ethnographically. The first type is a large wolf-like variety primarily bred for use as a sturdy pack animal. The second type is a smaller coyote-sized animal which may have been specially bred and fed

Site	Source	Specimen	Lower M1 Length (mm)	Lower M1 Width (mm)	Mandible Height (mm)
Museum Comparative Specimens	Morlan 1994a	Large Wolf	30.4	12.4	N/A
		Small Wolf	26.3	10.6	N/A
		Large Dog	24.2	10.5	N/A
		Small Dog	21.6	8.9	N/A
		Large Coyote	23.4	9	N/A
		Small Coyote	21.3	8	N/A
Harder site:	Morlan 1994a	FbNs-1: 5-10n0w	27.4	11.7	N/A
		FbNs-1: 5-10n0w	28.9	11.8	N/A
		FbNs-1: 55s0w	30.6	12	N/A
U fo S Comparative Specimens	Magee 1997	Average of 4 Canis lupus Specimens	28.76	N/A	30.56
			s.d=1.68	N/A	s.d=1.55
Sanderson site:	Magee 1997	DhMs-12: 68819	27.05	N/A	28.8
		DhMs-12: 70985	27.05	N/A	28.35
		DhMs-12: 53570	24.9	N/A	N/A
Oxbow Dam site:	Green 1998	DhMn-1: 1627	23.5	9.7	29.5
		DhMn-1: 1975	24.1	10.9	27.9

Table 6.9: Table illustrating dimensions of canid carnassial teeth (lower M 1) for wolf (*Canis lupus*), coyote (*Canis latrans*), and dog (*Canis familiaris*) from comparative faunal collections and archaeological specimens. Comparative specimens are from Morlan (1994a) and Magee (1997). Note similarity between DhMn-1 specimen dimensions and Morlan's measurements of large dogs. Morlan's (1994a: 762) measurements for the large dog specimen were of a male "true Eskimo dog as opposed to a Siberian Husky" from the Northwest Territories (NMC-41081).

for use as food (Berlandier 1969: 119, Lowie 1982: 37). While the origins of the two varieties of aboriginal dogs is speculative, at best, clearly some selective breeding was involved. In reference to Plains Cree dog breeding practices, castration was performed on most male pack dogs (Mandelbaum 1979: 67, Wilson 1978: 201) leaving only the largest uncastrated. According to Buffalo Bird Woman, among the Hidatsa, the first litter of pups was usually killed because they would grow up small. Of the next litters, only 3 or 4 of the largest pups were kept and the rest were killed so that the mother would remain in good health (Wilson 1924: 199). Although these selective processes were apparently applied to draught animals, it is reasonable to assume that similar practices using slightly different criteria was used for designated food animals.

A great deal has been written on the relationship between canids and humans in pre and post contact North America (Forbis 1993, Crabtree and Campana 1987, Thurman 1988, Bozell 1988, Snyder 1991, Wilson 1978, etc.). Certainly, canids were among the very first animal domesticates in many areas of the world. For Plains Indians, the dog was much coveted as a draught animal and, in many cases, a good source of protein and fat. Ethnographic accounts of Plains encampments often mention enormous numbers of dogs where large camps could have upwards of 4,000 dogs (Murray 1839: 202 as cited by Bozell 1988: 96, Dunbar 1918: 60 as cited by Snyder 1991: 360). During the Protohistoric Period, some Pawnee lodges reportedly had as many as a dozen dogs each (Irving 1955: 96 as cited by Bozell 1988: 95) with an average of about six or seven dogs per lodge (Murray 1839: 202 as cited by Bozell 1988: 96). Even with the arrival of the horse into Plains cultures, the dog was largely retained as draught animal (Lowie 1985: 37-41).

During historic times, the degree to which dogs were used as food varied greatly from group to group. The Arapaho were referred to as "Charticas" or "Dog Eaters" by the neighbouring Shoshone, although the term may have also applied to southern groups of Athapaskans (Thurman 1988: 159-170). Ethnographically, the Dakota (Pond 1986: 30, Lowie 1985: 39) reserved dog meat for ceremonies such as the Grass Dance. Similarly, the Plains Cree ate dog meat during a ceremony honoring the power of medicines (Mandelbaum 1979: 224). Others such as the Blackfoot and the Crow deny eating dog but appear to have utilized it as food during particularly difficult times when other sources of fat and protein were unavailable (Lowie 1985: 39). Snyder (1991:361) recently intimated that, to a certain extent, the professed aversion of some groups toward consuming dogs may have been a reaction to the predominant idea among Europeans that it was distasteful. Dog meat was prepared using several different steps and methods. Generally, after the dog had been killed, it was placed in a fire in order to singe off the hair while retaining the skin (Pond 1986: 51, Gilmore 1934: 37-38 as cited by Snyder 1991: 361). Following this, among the Arikara, the animal was washed, eviscerated, dismembered, and boiled in bear grease (Snyder 1991: 361). Snyder notes that this method of cooking helped retain the high levels of fat present in the dog. This method of cooking may not result in any charring of skeletal elements other than teeth, caudal vertebrae and phalanges which have little or no protection against heat.

Similarly, Morlan (1994b) notes that the presence of burned micro-rodent teeth and distal phalanges associated with any other burned or unburned elements may indicate roasting activities as the teeth and digits would be more directly exposed to hot coals than more heavily fleshed bones thus making them highly susceptible to charring. In such instances, microfaunal remains are not only palaeoenvironmental indicators, but also, exploited subsistence resources. Potentially, evidence of roasting increases the performance of microfauna as palaeoenvironmental indicators because they become irrefutably linked to human manipulation and more accurately reflect the environment at the time of occupation. As noted above, studies indicate that the percentages of edible meat verses body weight for small rodents such as mice, voles, and chipmunks can be extremely high, in the range of 80-90% (Stahl 1982: 822-829).

6.7.5 Cultural Level Six Summary

Level six appears to be an Oxbow campsite at which tools and weapons were repaired and manufactured, and bone was processed for marrow and grease extraction. This occupation has been radiocarbon dated to S-3648: cal 4513 [4277] 3994 BP. It contains the most diverse faunal assemblage of any of the cultural levels at the site. The remains indicate that while bison was the primary source of meat (91.6 % by weight), other animals were utilized to supplement the diet. Of particular interest are the presence of burned and butchered Western Painted Turtle (*Chrysemys picta belli*) and the high percentage of canid remains (7.9% by weight) within the assemblage. Analysis of carnassial teeth on two canid mandibles indicate that at least one of the specimens from this level was likely a domestic dog (*Canis familiaris*). Both of these resources have been discussed to varying degrees in the ethnographic literature, although the natural range of most turtles limits the documented use to areas south and east of the province.

6.8 Cultural Level Seven

Cultural level seven contains a sparse lithic and comminuted bone assemblage which may be in association with bison bone limb elements radiocarbon dated to S-3644:cal 7934 [7761] 7585 BP. The stratigraphic level is characteristic of a poorly developed Regosol.

6.8.1 Cultural Level Seven Lithics

6.8.1.1 Preform:

A single grey fused shale preform (Art.#1641) was recovered from unit 98N 29E. This preform (Plate 6.1: F) may be associated with the bison elements used for radiocarbon dating; however, the tool was not recovered *in situ* and its exact provenience is not known. Stylistically, the preform appears to be for a small, side-notched point rather than a stemmed point. The maker appears to given up on the tool after being unable to successfully thin the preform. The tool is largely unifacially retouched and poorly made.

6.7.1.2 Debitage:

Debitage from cultural level seven includes 5 SRC flakes (6.7 g), one white chalcedony flake (0.1 g), one quartzite flake (0.3 g), one generic chert flake (2.6 g), and one piece of silicified wood shatter (3.3 g). It should be noted that all the material types present in level seven are also found in upper levels and may, in fact, be attributable to those levels. It is difficult to assess the contemporaneity of the lithics and the radiocarbon dated bone because all of the debitage was recovered from the screen and not found *in situ*. Furthermore, many of the lithics and comminuted bone fragments were recovered from units where rodent burrows were recorded in planviews. In unit 98N 30E, for example, the excavator clearly depicts fragmented bone originating from a dark patch resembling a burrow.

6.8.2 *Cultural Level Seven Faunal Remains*

6.8.2.1 *Identified Faunal Remains:*

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison*
MNI = 2, NISP = 24
See Table 6.10 and Figure 6.4 for elements represented.

The MNI for bison for this level is based on the presence of two right radii. These radii are similar in size to one another and seem to be proportionately too large to be associated with hindlimb elements from the same level. It may be, therefore, that three (two large and one small) individuals are represented in the assemblage.

Class Mammalia, Order Rodentia, Family Sciuridae, *Spermophilus* cf. *richardsoni* (Richardson's ground squirrel)
MNI = 1, NISP = 1.
Remains include one unburned right femur (0.1 g).
This specimen was recovered from a rodent burrow.

Anatomical Portion	Element	Right	Left	Indt Side or Axial	Burned	Unburned	Total No. of Identified Fragments	Weight (grams)
Cranium	mandible	1				1	1	18.8
	premolar			1		1	1	1.9
Forelimb	radius	2				2	2	512.2/91.8
	ulna	1				1	1	130.8
	metacarpal	1				1	1	257.5
	radial	1				1	1	25.3
	ulnar	1				1	1	19.8
	internal	1				1	1	19.1
	unciform	1				1	1	21.6
Hindlimb	tibia		1			1	1	321.4
	lateral malleolus		1			1	1	7.5
	metatarsal		1			1	1	219
	tarsals: calcaneus		1			1	1	103.1
	fused Cent/4th		1			1	1	46.4
	astragalus		1			1	1	75.4
	fused 2nd/3rd		1			1	1	8.7
Phalanges	1st phalanx	1	1	1		3	3	116.9
	2nd phalanx			1		1	1	18.5
	3rd phalanx	1		1		2	2	35.8
	sesamoid	1				1	1	0.8

Table 6.10: Table indicating the NISP for Bison elements recovered from cultural level seven.

6.8.2.2 Unidentified Faunal Remains:

Cultural level seven contained 112 pieces of unburned bone (55.5 g), one unburned tooth fragment (0.3 g), and 68 pieces of burned bone (21.5 g).

6.8.3 Cultural Level Seven Discussion

As mentioned above, this level presents a conundrum in that, while small amounts of cultural material exist at the proper depth, the major bison elements recovered *in situ* do not exhibit any signs of cultural modification. However, the limb elements that are present are not associated with any axial elements (with the exception of one mandible fragment) suggesting that they were transported to the site as articulated units. Taphonomically, the bone is in near pristine condition, indicating that it must have been buried fairly quickly. Many of the elements do have visible signs of carnivore chewing as described by Binford (1981), but no signs of cutmarks, chopping or burning. Other Altithermal-aged components in the province at the Gowen sites near Saskatoon (Walker 1992), indicate that extensive bone processing occurred in order to maximize the amount of nutrients extracted from each carcass. This component, with its relatively early Altithermal age of S-3644: cal 7934 [7761] 7585 BP suggests that activities surrounding marrow extraction may not have occurred here. It is important to note, however, that the major marrow and grease-producing elements such as femura and humerii were not recovered, suggesting that these elements may have been relocated to a specific processing area which was not discovered during the excavation. Interestingly, the discoverer of the Oxbow Dam site (Lt. Inglis 1956), noted

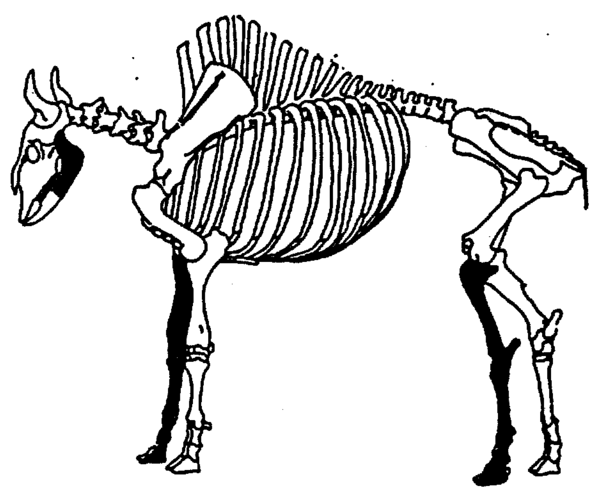


Figure 6.4: Bison elements represented in cultural level seven (adapted from Gilbert 1990: 36).

the presence of what appeared to be one or more complete articulated bison skeletons at this approximate level (see chapter four Figure 4.1.). Coincidentally, the current landowner noted that the point bar directly across from the site was seriously eroded during a flood in the 1960's and was completely covered with bison bone, including a large number of skulls. Although there is likely no way of determining the contemporaneity of these remains, it is possible that many bison died at the location in a cultural or natural mass kill at around 7500-8000 BP according to radiocarbon dated bone from this level.

6.8.4 Cultural Level Seven Summary

The bison bone elements associated with this strata have been radiocarbon dated but, although cultural material was recovered from the appropriate depth, it is extremely difficult to prove its contemporaneity with the dated bison remains. Virtually all of the pulverized bone and flake material that was noted during the actual digging process was attributed to various rodent burrows by the field crew. Unfortunately, even the fused shale preform was not recovered *in situ*, but rather, in the screen. However, the possibility that these artifacts actually do belong together should not be readily dismissed. The sparse nature of the assemblage is in keeping with Walker's (1992) assessment of 115 archaeological sites dating to the Altithermal period, many of which are multicomponent sites with earlier and later occupations that are considerably richer.

The bison remains recovered *in situ* from this component do not show obvious signs of cultural modification but, the segments represented are precisely the portions that regularly occur at precontact campsites or secondary butchering sites. No axial elements were recovered although the forelimbs of at least two bison, and the hindlimb of what appears to be another smaller bison were found. Also of interest, is the lack of femora and humerii for otherwise complete limbs. Such bones contain large amounts of marrow and grease and are often recovered in fragmentary condition from campsites and butchering~processing sites where the extraction of these substances was practiced. The absence of these elements from this component may indicate their relocation to another unknown area of the site where such processing took place. The excellent preservation of bone in this level is likely due to rapid burial through alluvial, colluvial or aeolian deposition. Support for this argument can be found in the strata itself, which appears as a poorly developed regosol. According to Moss (1978: 63, 64), regosols on floodplains often represent immature soils that have not had time to develop because of periodic deposition of alluvium. This phenomenon can be attributed to the unstable conditions of the Altithermal during which time rapid deposition and erosion occurred due to episodic fluctuations in climatic conditions. It is likely that a considerable amount of erosion took place on the terrace shortly before the stabilization and development of soils occupied during Oxbow times at around S-3648: cal 4513 [4277] 3994 BP. The separation between level seven and the overlying level six is less than 5 cm in places, while the time elapsed between the levels potentially ranges between 3200 and 3900 years. Wettlaufer (1960: 110) notes that a period of rapid deposition occurred at the Long Creek site between level seven (S-50: cal 5720 [5317] 4869 BP: Morlan 1993) and level eight (S-52 and S-53 average: cal 5567 [5319]

5054 BP: Morlan 1993) where almost 60 cm of sand separate levels that are potentially very close in age.

6.9 Results of Deep Testing

It is possible that an older, presumably Paleoindian, component exists at the site as well. A fused shale soft hammer percussion flake and a portion of a bison mandible with visible cutmarks on it were recovered from a deep test unit at a level approximately 120 cm below cultural level seven. No easily distinguishable palaeosol was apparent at the level but, a small burrow was encountered that may have been a conduit for the vertical transport of the artifacts. However, the taphonomic processes at work on these remains give them a much different appearance from any other bones recovered at the site. Unfortunately, time constraints negated further investigation of this level which is 275 cm below the site datum or 115 cm below the bison bone elements in cultural level seven.

CHAPTER SEVEN

A RE-ANALYSIS OF THE 1956 OXBOW DAM SITE ASSEMBLAGE

7.1 Problems with the 1956 Research

The excavation at DhMn-1 in 1956 (Nero and McCorquodale 1958) produced an unique assemblage of artifacts which was subsequently used in conjunction with a larger sample of similar materials from Long Creek (Wettlaufer and Mayer-Oakes 1960) to define the Oxbow complex on the Northern Plains. The original Saskatchewan Museum of Natural History (now the Royal Saskatchewan Museum) site collection and publication (Nero and McCorquodale 1958) have been extremely influential in Middle Precontact Period studies across the Plains and peripheral regions. While the historical importance of the assemblage is noted (e.g., type-site designation), researchers have tended to overlook the sample size and the circumstances surrounding the original excavation with the result that some confusion has arisen over what the assemblage represents. Upon a thorough re-examination of the collection and supporting published and unpublished information, several important issues are apparent which may aid others in the interpretation of the site. First and foremost, is the fact that much of the assemblage came from an excavated trench four by eight and one half feet in size and roughly four feet deep (Nero and McCorquodale 1958: 85). This corresponds to an area of just over three square meters (Plate 7.1 and Figure 7.1). Secondly, the collecting of faunal specimens seems to have been a piecemeal affair, with specimens

Plate 7.1: View looking southeast toward test trench excavated at DhMn-1 in 1956. Trench is four feet wide by eight and one-half feet long. Note sloping topography. Photograph courtesy of the Royal Saskatchewan Museum.

originating from at least three separate visits to the site by various individuals during the spring and summer of 1956. Consequently, provenience information on these items is often poor but it is relatively clear that much of the bone was not from the Oxbow level. This problem has been exacerbated because the data has been subsequently recycled and

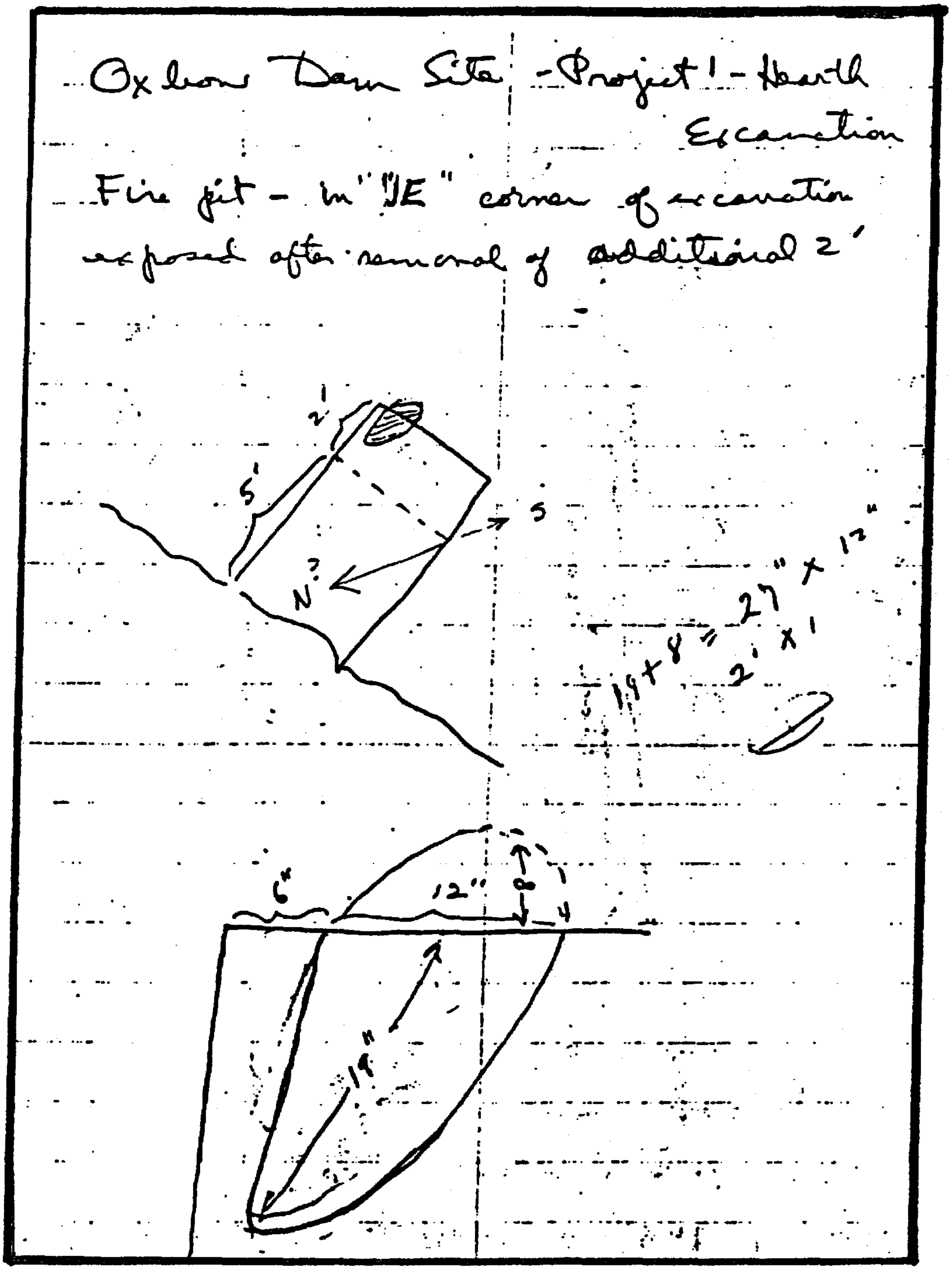


Figure 7.1: Fieldnotes from the 1956 excavation at DhMn-1 showing the size and orientation of the test trench including the location of the hearth feature used for radiocarbon dating. Cutbank edge is denoted by the wavy line in the lower left edge of the upper sketch. (Courtesy of the Royal Saskatchewan Museum).

sterilized, often omitting the authors' comments on tentative identifications within the faunal assemblage (Nero and McCorquodale 1958). Often the original list of identified fauna has been reproduced with tentative identifications presented as conclusive (see Buchner 1979: 82; Dyck 1977: 69; Millar 1981b: 84). Furthermore, although any number of radiocarbon dates from other Oxbow excavations have been thoroughly scrutinized because they are young in comparison to the original DhMn-1 radiocarbon date of S-44: 5200+/-130 rcybp (Nero and McCorquodale 1958), the original date is very rarely called into question. This seems remarkable in that it stands beyond the range of the majority of Oxbow dates and was processed during the infancy of radiocarbon dating technology. Certainly part of the problem is that the variation in projectile point morphology has been misconstrued as representing an earlier proto-Oxbow complex within the Mummy Cave series (Dyck 1983:92-95, Reeves 1973: 1245). This is not the fault of any of the previous researchers, it is merely an unfortunate coincidence that each of the styles of projectile points recovered has a Mummy Cave series counterpart. In a sense, the DhMn-1 collection could be regarded as a counterfeit Mummy Cave series assemblage. When combined with a potentially contaminated early-Oxbow radiocarbon date, the assemblage creates a very convincing Mummy Cave~Oxbow transitional assemblage, when in fact, it is actually a very typical Oxbow assemblage. Moreover, recent excavations at the site revealed that major stratigraphic problems may exist for the original assemblage. It is quite possible that a much older early Mummy Cave component exists at DhMn-1 below the Oxbow component. Each of the elements in Morlan's (1993: 3) "powerful triumvirate" comprised of stratigraphy, projectile point typologies, and radiocarbon dating, which was used extensively to establish a Plains precontact cultural chronology, has been questioned regarding the original assessment of DhMn-1. However, despite the circumstances surrounding the excavation, the fact that the museum researchers conducted a competent and thorough examination of the assemblage cannot be overstated. Clearly, the original publication (Nero and McCorquodale 1958) was intended to raise awareness of the site in hopes of attracting a qualified archaeologist to conduct further research (Nero 1956). Unfortunately, the article may have been so well presented that other potential researchers thought all necessary work had been completed.

Presented here is a reinterpretation of the original site assemblage and documentation made with the benefit of 40 years worth of supporting research on the Oxbow complex by numerous Plains archaeologists. Many previously unreleased photographs and supporting documents are presented here for the first time. The Royal Saskatchewan Museum must be commended for its forethought in retaining the complete assemblage. Much of the background material for this section is contained in chapters four, five and six of this document.

7.2 A Re-examination of 1956 DhMn-1 Stratigraphy

Considerable confusion exists regarding the stratigraphic context of the Oxbow assemblage from 1956. Although several bone-yielding strata are noted in the publication (Nero and McCorquodale 1958: 85), the authors state that, " nearly all of the 26 artifacts and 471 flint flakes which were found were located *in situ* and in direct association with the hearth." Many subsequent researchers interpreted this as meaning that the site was single component when, in fact, it was not. Nero and McCorquodale (1958: 85) note three reasonably distinct layers in the publication, the lowermost containing a hearth and a heavy concentration of cultural material. Illustrations in field notes indicate that the hearth feature actually cut through a lower level which reportedly contained ash and bone (Figure 7.2). This level is recorded as being two inches below the level from which the hearth originated. This description fits the findings of the 1996 excavations very well. According to the recent excavations, the hearth feature likely originated in cultural level six (Oxbow) while the underlying level of ash and bone corresponds to cultural level seven. This may be a source of contamination for the original museum radiocarbon date. According to museum documents (Figures 7.1 and 7.2), the ash feature used to date the component was detected after the test trench was extended an additional two feet (approximately 60 cm) and only artifact number A69/6249: 131, a Swan River Chert endscraper, was recovered from that area. In order to avoid trampling on the artifacts, the majority of the assemblage was likely removed before the hearth feature was detected. The precise location of the 1956 excavation could not be relocated. The landowners, who remember the museum work, state that the exact area has since been completely eroded away in subsequent floods (L. Workman and G. Workman pers. com.). Photographs (Plates 7.2 to 7.5) of the original excavation strongly suggest that the test trench was located in an area that had slumped resulting in deformation of the stratigraphic profile.

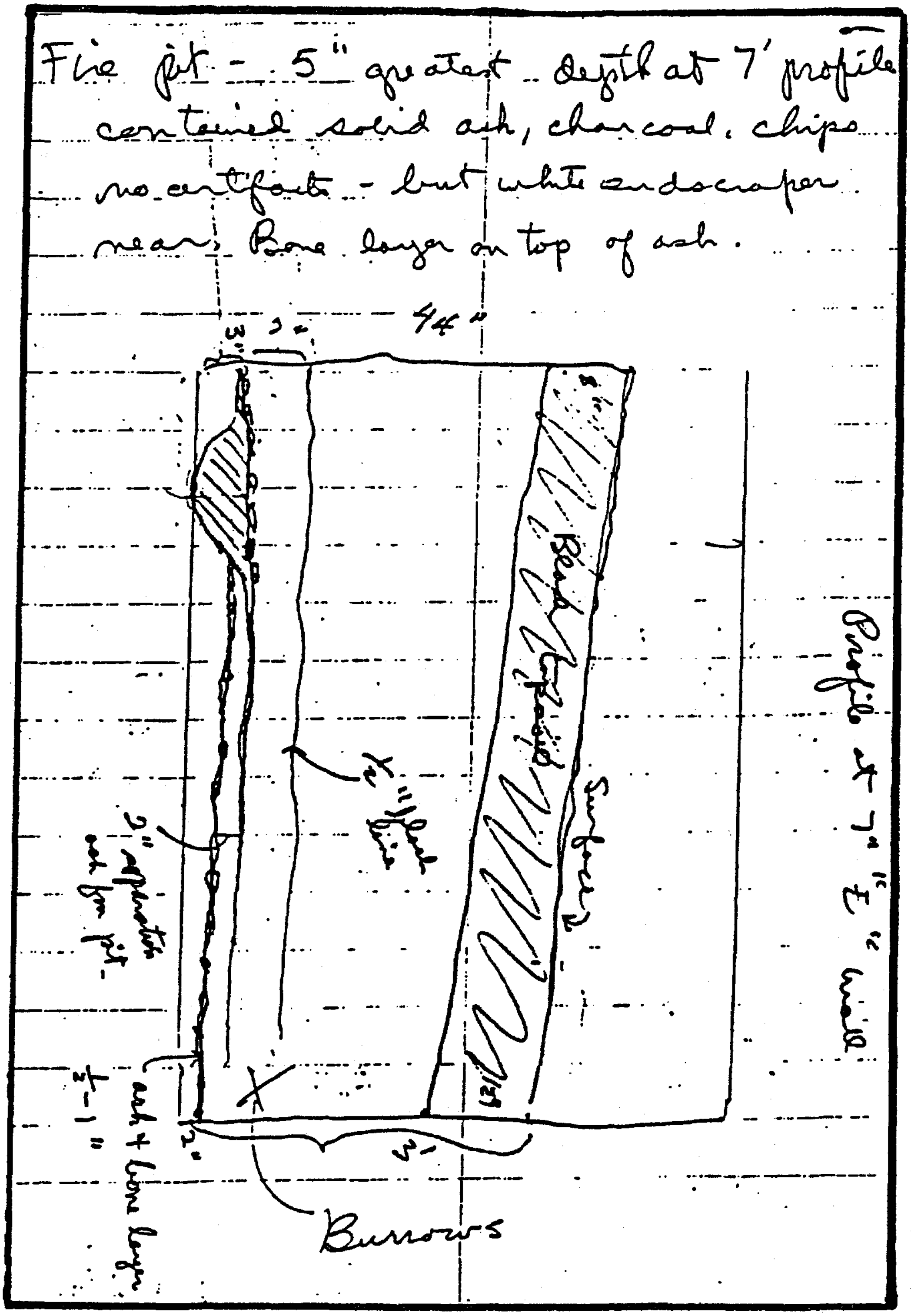


Figure 7.2: Fieldnotes from the 1956 excavation at DhMn-1 depicting stratigraphic profile of the "East" (southeast) wall of the excavation trench. Note that the hearth feature bisects a discrete bone and charcoal level below it. Courtesy of the Royal Saskatchewan Museum.

Plate 7.2: View looking northwest toward the eroded cutbank at DhMn-1. Apparently, this photograph was not taken during the July 17 -19, 1956 excavation. The dam which is illustrated in this photograph is the structure still in use today, built around 1962 (L. Workman pers. com.). The excavation trench was located immediately behind the trees above the person in the right side of the photograph. Courtesy of the Royal Saskatchewan Museum.

7.3 Evaluation of the 1950's Radiocarbon Date from DhMn-1

As mentioned above, the museum research produced a radiocarbon date of S-44: cal 6289 [5947] 5666 BP (Morlan 1993) based on charcoal from a

Plate 7.3: Photograph looking northwest depicting site location on slumped portion of the east bank of the Souris River. The excavation trench was located behind the trees on the right of the photograph. This photograph was taken some time after 1962. Courtesy of the Royal Saskatchewan Museum.

hearth feature which cut through an older charcoal-flecked level which may have contaminated the sample (Figure 7.2). Support for this position comes from two new radiocarbon dates on single bone elements, one directly associated with a level yielding portions of five typical Oxbow complex projectile points and one preform, and a second associated with a

Plate 7.4: Photograph looking southeast toward freshly eroded cutbank and museum test trench excavated between July 17th and July 19th, 1956. Note the location of the trench on a slumped portion of the bank and the deformation of dark stratum as it slopes toward the trench. Courtesy of the Royal Saskatchewan Museum.

charcoal-flecked level immediately beneath it. The two samples, S-3648 (cal 4513 [4277] 3994 BP) and S-3644 (cal 7934 [7761] 7585 BP), fall on either side of the original museum date. The average of the two new dates, at 6019 calendar years before present is well within one standard deviation of

Plate 7.5: Photograph looking south toward museum test trench on a slumped portion of the east bank of the Souris River. Note the deformation of the dark stratum containing a metapodial in the upper central area of the photograph. Courtesy of the Royal Saskatchewan Museum.

the calibrated original age of S-44: 6177 [5947] 5769 BP (Morlan 1993). Another possible explanation for the relative antiquity of the museum radiocarbon date (S-44) when compared with other Oxbow complex dates is that finely disseminated lignite may have contaminated the ash matrix. Ponomorenko (pers. com.) suggests that charcoal and other material are frequently associated with flood deposits and simply represent the redeposition of formerly upstream sediments. Large lignite deposits exist along the Souris River in the Cretaceous Ravenscrag Formation upstream from DhMn-1 near Estevan (SBDA 1987b). Artz (1989 as cited by Artz 1995: 74) reports this form of contamination from North Dakota where lignite contaminated humates from the Goodman Creek site produced a radiocarbon age of 9,190 +/- 40 rcybp for archaeological material diagnostic of the McKean/Duncan/Hanna complex of the Late Middle Precontact Period and from the Emerson site, where lignite contamination was likely responsible for radiocarbon ages which were consistently between 3000 and 7000 years older than the diagnostic artifacts indicated. Gregg *et al.* (1986 as cited by Artz 1995) have also noted the problem of alluvial transport of older materials into more recent alluvium along the James River in eastern North Dakota. Fine lignite is reportedly indistinguishable from wood charcoal even under a binocular microscope (Hajic and Ahler 1992; as cited by Artz 1995) and must be separated chemically from samples before dating (Root et al. 1986; as cited by Artz 1995).

7.4 Critical Evaluation of the 1956 DhMn-1 Lithic Assemblage

In spite of the aforementioned problems with potential mixing, the lithics are presented as a single assemblage. Comments regarding potential associations for specific items are presented wherever possible. Artifacts that were recorded as being retrieved out of context are discussed as such. When these items closely match material types or point styles found in other levels, comparisons will be drawn.

7.4.1 Projectile Points

The assemblage contains portions of five projectile points, all of which appear in Plate 7.6. One is relatively complete small point made of banded chert (Plate 7.6: A). The point (museum: A69/6249 : 125) is a side-notched variety with a slightly concave (sub-concave: Dyck 1970) basal margin which exhibits thinning on only one surface near the center of the base. The point was recovered in three pieces on three separate occasions (Nero and McCorquodale 1958). The tip was found by the discoverer of the site during an initial visit and the base was recovered by the museum staff while at the site although no provenience data was given. A small lateral fragment of the point was recovered from the flakes and debitage brought back to the museum. The breaks are oriented along the coloured bands and it may have been broken during the notching stage of the manufacturing process. The point exhibits no signs of grinding. Typologically, this is perhaps, the most difficult artifact to classify in that its relatively small size and square base make it reminiscent of Plains Side-Notched varieties of a much later date. Conversely, however, it may be related to square-based Mummy Cave series points such as Bitterroot. It is strikingly similar to a small side-notched projectile point from level eight at Long Creek (see chapter four Plate 4.2: G). A final consideration must be that the point is associated with the Oxbow level. Although the silhouette of the point is atypical of the complex, idiosyncratic manufacturing techniques are similar to those used on two other points (A 69/6249: 128 and A69/6249: 126) that have been attributed to the Oxbow complex. Specifically, notching is achieved on all three specimens primarily through unifacial retouch. Museum artifact number A69/6249: 127 is a Knife River Flint projectile

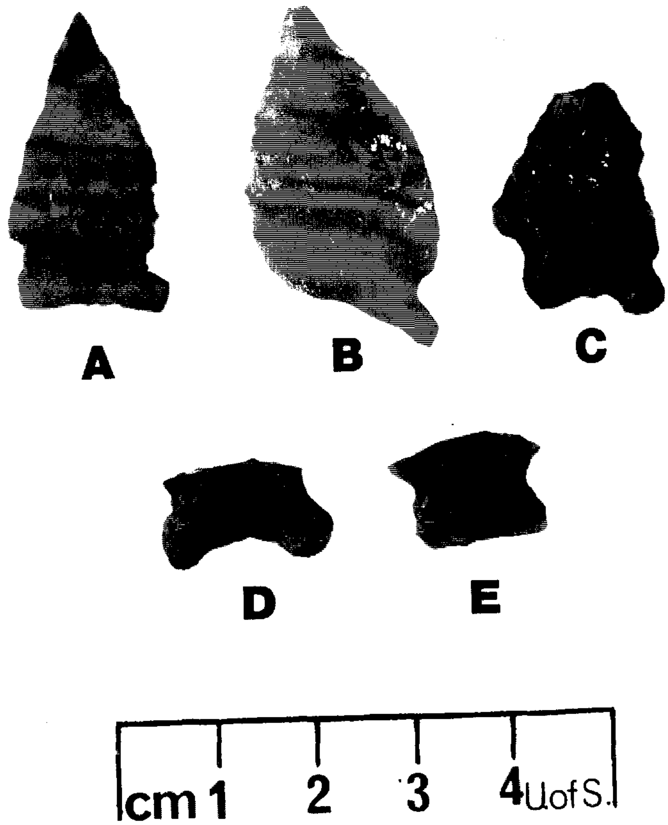


Plate 7.6: Projectile points recovered during the 1956 Saskatchewan Museum of Natural History excavations at DhMn-1. A: grey banded chert projectile point (Art. # A69/6249: 125), B: Swan River Chert (Oxbow?) projectile point (Art. # A69/6249: 128), C: Knife River Flint (Oxbow) projectile point (Art. # A69/6249: 135), D: jasper (Oxbow) projectile point base (Art. # A69/6249: 126), E: Knife River Flint (Hanna?) projectile point base (Art. # A69/6249: 127).

point base likely assignable to the Hanna phase of the McKean/Duncan/Hanna complex. While only the basal stem is represented (Plate 7.6: E), it is sufficiently similar to a jasper Hanna base recovered from cultural level five, during the 1996 season, to be included within that assemblage. Nero and McCorquodale (1958: 85) state that the Knife River Flint base was found in backdirt left by Lt. Inglis or some unknown party. The remaining three projectile points are all reasonable examples of Oxbow points. Museum artifact number A69/6249: 128 is a symmetrical Swan River Chert side-notched projectile point with slightly excurvate lateral margins and nipple-like tip similar to examples from the Harder site described by Dyck (1977: 73). The point (Plate 7.6: B) exhibits stacked hinge fractures on one surface which resulted in a thick lump of material along the longitudinal midline. The side-notch was unifacially pressure-flaked and subsequently ground. A large portion of the base is missing so assignment to the Oxbow assemblage is tentative. However, the high percentage of Swan River Chert of comparable quality recovered from level six during the 1995 and 1996 excavations strongly suggests that this item belongs with the Oxbow assemblage. A jasper Oxbow projectile point base (Plate 7.6: D) is catalogued as museum number A69/6249: 126. Like the Swan River Chert point described above, this example is basally-thinned on only one surface. The basal margin is concave and the lugs or ears are asymmetrical as are the side-notches. The notches show signs of grinding and/or crushing. Projectile point A69/6249: 135 is made of Knife River Flint which was exposed to extreme heat following completion. Whether or not the point (Plate 7.6: C) was damaged and then discarded in a fire is impossible to determine as all of the damage, including portions that are completely missing, appears to be heat related. Discoloration, crazing, cracking and heat spalls or 'potlids' all occur when chalcedonies are heated to temperatures well in access of 300 degrees Celsius (Johnson 1993: 56). This projectile point exhibits all of the above mentioned characteristics. It has a narrow base and a relatively sharp-shouldered appearance which is atypical of Oxbow projectile points; however its overall appearance is consistent with points of the Oxbow complex. Basal thinning flakes have been removed from the point and it has a deeply concave base, but, grinding is not apparent.

7.4.2 *Bifaces*

In total the 1956 assemblage contains five bifaces of variable configurations, three of which were not included in the original publication. Museum artifact number A69/6249: 140 (not illustrated) was originally recorded as debitage but appears to be a clear example of what Wettlaufer (1960: 59-61) refers to as an "ovate blade" or more commonly called an ovate biface. The item is made from banded orange, red and grey heat-treated Swan River Chert which is virtually identical to material used for an ovate biface (art # 1254: chapter six Plate 6.3: C) of similar proportions recovered from cultural level six in 1996. Specimen A69/6249: 140 has been completely shaped by well-executed soft-hammer percussion flaking creating an undulating edge while one edge that has not been retouched, presumably to act as a "backed" biface. A similar item was retrieved from a bag of debitage catalogued as A69/6249: 102 (not illustrated). This artifact is essentially an ovate biface although it is not quite as skillfully prepared as other examples. The artifact is made of pink and white heat-treated Swan River Chert and features the same manufacturing technique resulting in an undulating edge and, again, one edge has not been retouched to act as backing. A dark gray biface similar to those previously discussed is catalogued as A69/6249: 142 (not illustrated). Again, this item was originally catalogued as debitage but re-examination indicates that the object is essentially the same as the ovate bifaces but that the retouched portion does not follow the majority of the edge. Instead, the bifacially retouched area forms only a slightly convex cutting edge which is straight rather than sinuous, while three other edges are not retouched. This item is essentially wedge-shaped with the thin end of the wedge at the retouched edge. Artifact number A69/6249: 134 is a fragment of an asymmetrical biface with a lenticular transverse cross-section. This item was originally illustrated as artifact "K" in figure 5 of Nero and McCorquodale 1958. Although this object has been bifacially retouched, one of the corners appears to have been fashioned into a perforator and therefore, it should be recorded as such. The perforator is made from vug-filled heat-treated Swan River Chert, consistent with other artifacts from cultural level six. A mid-body fragment of a Knife River Flint biface is catalogued as A69/6249: 133 and is illustrated as object "H" in figure 5 of Nero and McCorquodale (1958). This thin biface fragment is lenticular in transverse cross-section and exhibits long pressure flake scars which meet at the approximate longitudinal midline of the item.

7.4.3 Unifaces

Unifacial tools include a broad range of items which served functions from cutting and scraping to drilling. Many of the items included in this category are little more than marginally retouched flakes, while others are purposefully shaped tools which fit a preconceived concept or mental template. Of the latter class, end scrapers are perhaps the most common. All of the remaining tools in this section were reportedly in direct association with the hearth feature used to date the site except for those tools collected by Lt. Inglis. Artifact number A69/6249: 130 (Plate 7.7: B) is an endscraper made from Knife River Flint. The tool has a prominent bulb of percussion on the ventral surface opposite to the working edge. The working edge is carefully pressure-flaked to form a convex beveled edge. A prominent remnant dorsal ridge runs the length of the item while the right lateral margin still exhibits the light brown cortical surface of the chalcedony. The left lateral margin has been knapped to form a slightly concave edge which appears to have been utilized as a concave scraper. In transverse cross-section the tool's dorsal surface appears peaked while the ventral surface is slightly convex. A second Knife River Flint endscraper is recorded as A69/6249: 119 (Plate 7.7: A). This item is represented by only its distal working edge, which has been precisely pressure-flaked to form a near perfect arc. Artifact number 69/6249:131 is a distal fragment of a carefully formed banded gray and white Swan River Chert end/sidescraper. This object (Plate 7.7: C) is remarkably similar in proportion and manufacturing technique to a finely made Swan River Chert end/sidescraper (art # 2611) recovered from cultural level six. Both objects exhibit a pair of dorsal ridges running the length of the carefully prepare flakes on which they are made. Apart from slight differences in material type, these objects are so similar, that they appear to have been made by the same person. A robust heat-treated Swan River Chert sidescraper was previously catalogued as debitage. This artifact (A49/6222: 78) was reportedly recovered by Lt. Inglis, the discoverer of the site. The tool is a thick flake with a longitudinally oriented dorsal ridge with areas of cortex still evident at the distal end and left lateral edge, while the right lateral edge has been retouched to form a moderately beveled convex working edge (Plate 7.7: D). A large coarse-grained chert scraper (Plate 7.7: E) was recovered from debitage catalogued as

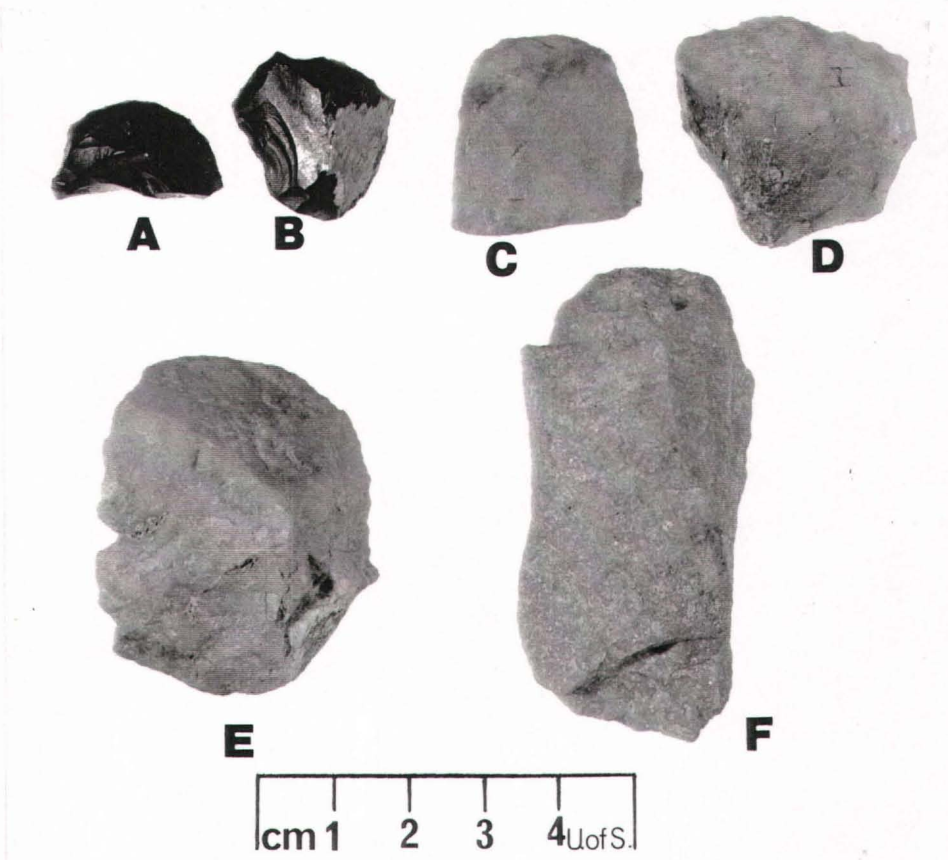


Plate 7.7: Unifacial scrapers from 1956 Saskatchewan Museum of Natural History excavations at DhMn-1. A: Knife River Flint endscraper fragment (Art.# A69/6249: 119), B: Knife River Flint endscraper (Art.# A69/6249: 130), C: banded Swan River Chert end/sidescraper (Art. # 69/6249: 131), D: Swan River Chert scraper (A49/6222: 78), E: coarse-grained robust scraper (A69/6249: 116), F: coarse-grained endscraper (A69/6249: 102). Note that items D, E, and F were previously catalogued as debitage.

A69/6249: 102. The material type makes flake scars extremely difficult to detect, but a steeply-beveled working edge is apparent on one end of this item. The dorsal surface is extremely convex longitudinally, while the ventral surface is planar. Artifact number A69/6249: 116 was also recovered from debitage and is of the same coarse-grained chert as that previously discussed. The object is a minimally retouched ovoid flake (Plate 7.7: F) that shows signs of use-wear along one edge. It has a peaked dorsal surface and a slightly convex transverse ventral surface.

7.4.4 Unifacially Retouched Flake Tools

This category of artifacts includes a variety of effective but quickly produced expediency tools. A grey fused shale concave scraper was recovered from debitage catalogued as A69/6249: 108 (not illustrated). The item appears to have been noted by museum staff, who drew a series of 'x's and lines on its surfaces. The object features a quickly but carefully retouched concave scraping edge where the ventral surface of the tool is actually the red cortical surface of the rock, while the ventral surface of the flake is the dorsal surface of the tool. The next six objects correspond to Dyck's (1977: 124-131) classification of thin uniface knives. This class of artifact features a sharp, unifacially prepared cutting edge produced on a thin flake. A pale green cortical flake of fused shale (A69/6249: 139) exhibits unifacial retouch along one lateral edge to form a straight, thin working edge approximately 22 mm in length and less than 3 mm thick (not illustrated). The dorsal surface of the tool is completely covered in sandy brown cortical material. Artifact number A69/6249: 129 is a thin Knife River Flint flake that has been unifacially retouched along two opposing edges (not illustrated). Similarly, artifact number A69/6249: 88 is a Knife River Flint flake that has been retouched along two opposing lateral margins to produce sharp cutting edges (not illustrated). Another unifacial knife fragment is represented by artifact number A69/6249: 136 (not illustrated). This item is made from an unidentified lustrous dark grey, finely-banded material of high quality. The thin flake has been retouched along one lateral edge to produce a sharp cutting edge. A thin flake of heat-treated Swan River Chert, collected by Lt. Inglis, was also unifacially retouched in the same manner (A49/6222:80, not illustrated). Finally, artifact number A69/6249: 132 has been recorded and reported as a biface (see Nero and McCorquodale 1958: fig 5: M), but this crudely made Swan River Chert expediency tool is a uniface. The tool is made on a heat-treated flake with a diamond-shaped transverse cross-section. One lateral edge has been retouched to form a cutting edge approximately 43 mm long.

7.4.5 Debitage

Only a very rudimentary analysis of the debitage collected in 1956 was conducted. Museum workers noted that 10 flakes within the debitage appeared to have been retouched (Nero and McCorquodale 1958: 87). Of these artifacts, six have been reclassified as thin uniface knives following Dyck (1977), and four others exhibit minute edge damage, characteristic of utilization rather than retouch. Very little was done with the remaining debitage in terms of re-analysis because of a lack of provenience information. Specifically, each bag of debitage was examined for the presence of other previously unrecognized tools, then debitage material types were noted and certain types were compared qualitatively to examples from the 1995 and 1996 excavations. Surprisingly, although many of the tools were made of materials such as Swan River Chert (SRC), Knife River

Flint (KRF) and fused shale, a great deal of the debitage is of different material. The museum excavation recovered a diverse array of well represented materials like Tongue River Silicified Sediment, basalt, white quartz, red quartzite, flaked limestone and sandstone, as well as high percentages of KRF, SRC and grey fused shale. Of interest and not frequently noted elsewhere, is a consistent pattern of heat-treating Swan River Chert for tool production. While Johnson (1986) reports no improvement in quality with respect to heat-treated SRC, others experimenting with heat treated cherts notice great improvements in knappability when the proper combinations of temperature and time are achieved (T. Stevenson, pers. com.).

7.5 The 1956 DhMn-1 Faunal Assemblage

In an attempt to reconstruct the events that took place at DhMn-1 during the summer of 1956, the organization of this portion of the chapter follows a format used by the Saskatchewan Museum of Natural History. Unfortunately, the horizontal and vertical provenience is not known for many of the bone elements. However, museum records separate the assemblage into six categories including items collected by R.W. Nero on his initial visit to the site, recoveries made by Lt. Inglis during his museum guided tests, artifacts recovered by the museum from zone I above the hearth, artifacts recovered by the museum from zone II above the hearth, artifacts recovered by the museum from the hearth (zone III) and a general category of artifacts recovered by the museum from the controlled excavation without further provenience. Consequently, it seems reasonable to retain these categories for purposes of this analysis.

7.5.1 Bone Tools

Provenience: unknown (records state: controlled excavation).

One bone item in the assemblage was once thought to represent a tool. Although no mention of this item appears in the museum publication (Nero and McCorquodale 1958), it may be documented elsewhere. The object in question (A69/6249: 71, not illustrated) is virtually identical to items described as "beamer tools" in the Long Creek site volume (Wettlaufer and Mayer-Oakes 1960: 63). Binford (1981) has demonstrated that many so-called bone tools are the work of carnivores. The items display flaking and polishing resulting from the chewing behavior of canids and other carnivores, and are not the work of humans. The DhMn-1 example has clear depressions and gouges produced by canine teeth. The item appears to be a lateral shaft fragment of a bison radius.

7.5.2 Shell Gorget

Provenience: unknown (records state: controlled excavation)

Perhaps the most remarkable artifact recovered from DhMn-1 is a fragment of an ochre-stained shell gorget or pendant (Plate 7.8). The artifact features red ochre staining over the exterior surface of a freshwater clamshell which has been carefully cut and ground into a tabular shape. A slightly elliptical hole approximately three millimeters in diameter has been drilled near one corner of the tablet apparently by using a sharpened object in a rotary fashion from both surfaces of the pendant resulting in a hole with a biconical cross-section. The pearly inner surface of the shell is

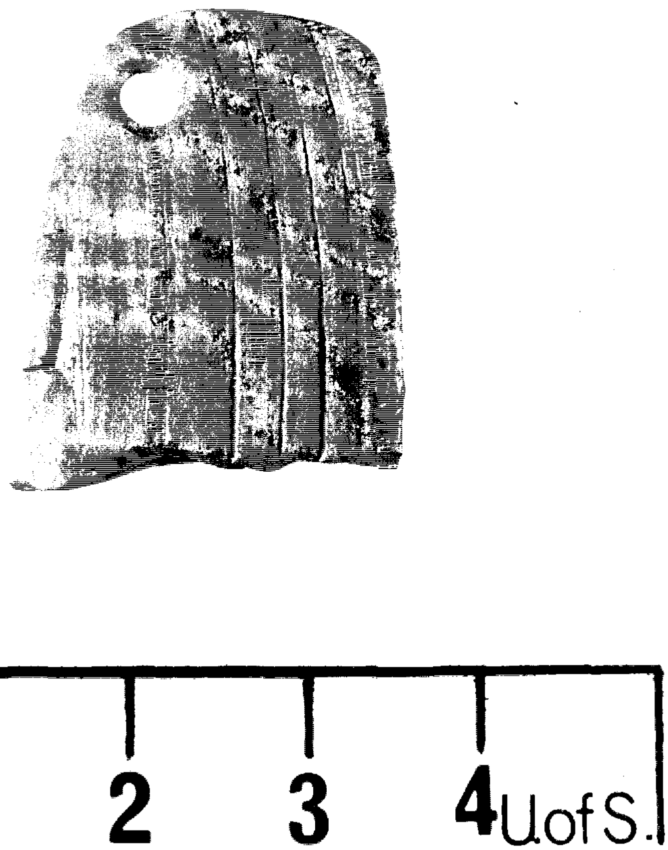


Plate 7.8: Shell pendant recovered during Saskatchewan Museum of Natural History excavations at DhMn-1 in 1956. Dark patches are red-ochre stains. Note the highly polished edges of the object.

unaltered but for red ochre staining in the rim of the drilled hole. The offset placement of the hole suggests that the object originally had another matching half with a corresponding hole and that it was suspended laterally across the neck. Early photographs, drawings and paintings commonly depict such items being suspended closely, but loosely, around the neck on a cord of babiche or braided fibres knotted once through each hole, with the pearly inner surface of the shell oriented outward (see photograph of Potawatomi boy : Chicago Historical Society ICHi-13896: as reproduced in Paterek 1994:70, C.M Russell's sketch of Blackfoot group: as reproduced in Yenne 1986: 29, and G. Catlin's painting of an Iowa medicine man: as reproduced in Yenne 1986: 79). A similar, but much larger, gorget was recovered from a burial at the Gray Site (Millar 1978: 331). Both examples appear to have been made from the shell of a locally available genus of freshwater clam, most likely *Lampsilus* sp.

7.5.3 Faunal Material Collected by R.W. Nero on His First Visit to the Site

This small collection of items was made by R.W. Nero on his initial visit to the location on June first or second, 1956, following Lt. Inglis' May 25th, 1956 discovery.

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison.*
MNI = 1. NISP = 3.
The elements represented include one unburned right calcaneum of a large bison, one unburned upper left first molar and one unburned right distal metatarsal of a large bison.

7.5.4 Faunal Material Collected by Lt. Inglis

These artifacts were recovered by Lieutenant Inglis during tests conducted under the guidance of the museum staff members on July 12th and 13th of 1956. Museum staff members suggested that Inglis should continue to monitor the site until they were available to examine it first hand (Nero and McCorquodale 1958: 82). According to museum records, the exact provenience for these items is not known but Lt. Inglis indicated to the staff that nearly all of the items were recovered from ash in the hearth feature or the same strata adjacent to the later museum test trench (Figures 7.3 and 7.4). As with the lithic materials, comments regarding the provenience of these items will be presented wherever possible. Interestingly, this portion of the collection contains the only example of burned bone as well as the only samples which exhibit cutmarks. .

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison.*
modified MNI = 3 (based on second phalanges which represent varying sizes and ages of bison). NISP = 21.
Unburned bison remains include one atlas vertebrae of a large bison (503.4 g), one neural spine of a thoracic vertebrae (78.3 g), one centrum of a thoracic vertebrae (22.1 g), one left second phalanx of a large bison (45.4 g), one second phalanx of a juvenile bison without proximal epiphysis (19.0 g), one left second phalanx of a medium-sized bison with cutmarks (31.7 g), one long bone shaft fragment with a series of diagonal cutmarks (12.8 g), one distal metapodial fragment (4.4 g), one left radial carpal (11.5 g), one right lower third premolar (6.6 g), one right lower fourth premolar (15.8 g), one right lower first molar (23.2 g) one right lower third molar (36.0 g), three indeterminate tooth fragments (10.5 g), one left upper first molar (27.0 g) and one left lower first molar (15.4 g)

Burned bison remains include one proximal astragalus fragment (2.2 g) and one burned sesamoid (4.6 g).

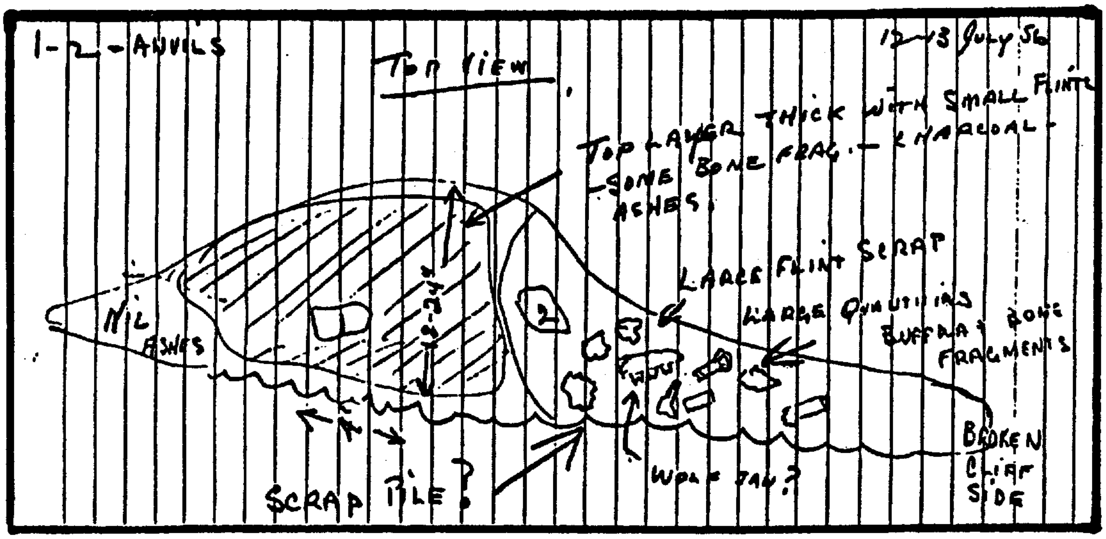


Figure 7.3: Lt. Inglis' planview sketch of the area adjacent to the museum tests drawn on July 12th or 13th, 1956 during his museum-guided tests. Note the wolf mandible in lower left corner. Courtesy of the Royal Saskatchewan Museum.

Class Mammalia, Order Carnivora, Family Canidae, cf.*Canis lupus.* (wolf).

MNI = 1. NISP = 6.

This sample is represented entirely by large canid elements comparable in size and morphology to *Canis lupus* specimens in the faunal comparative collection of the Department of Anthropology and Archaeology at the University of Saskatchewan. Unburned elements include one left mandible horizontal ramus (60.9 g) with cutmarks on the medial side at the base of the ascending ramus (Plate 7.9: C), one (30.3 g) distal half of left humerus (Plate 7.8: D), three distal metapodial (4.2 g) fragments, and one proximal

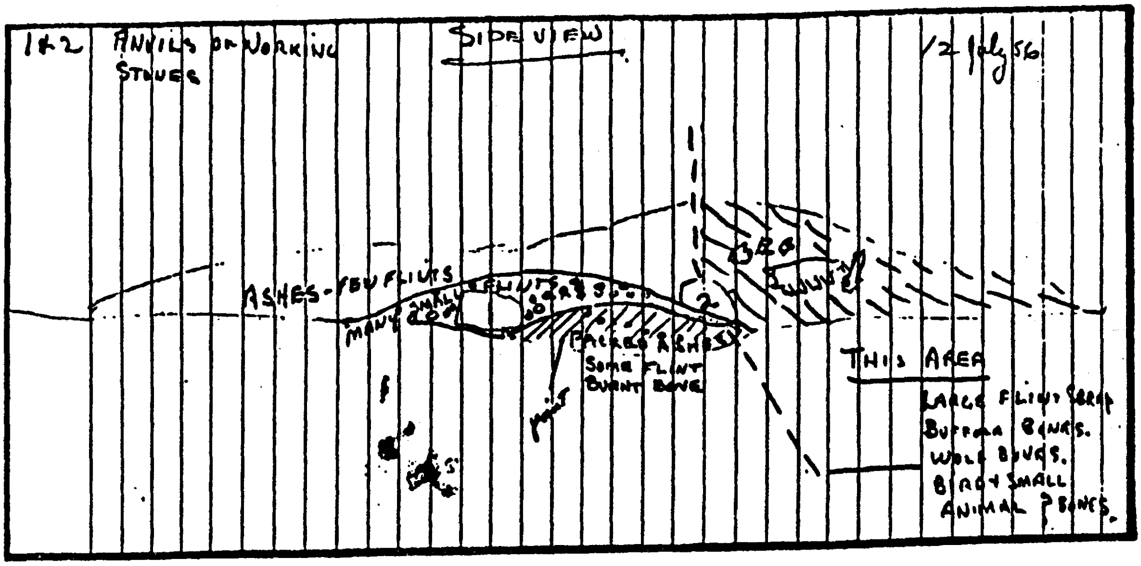


Figure 7.4: Profile sketch of area tested by Lt. Inglis on July 12th 1956. This is a side view of the same feature shown in Figure 7.3. Feature appears to be a dumping area for ash, bone and lithic debitage. Courtesy of the Royal Saskatchewan Museum.

fourth metatarsal (1.4 g). The wolf mandible is shown in a planview drawn by Lt. Inglis on during his preliminary tests (Figures 7.3 and 7.4).

7.5.5 Faunal Material Recovered from Zone I:

Artifacts from this level correspond with a "black zone" silt layer approximately five centimeters thick and 30 centimeters above the hearth level as reported by Nero and McCorquodale (1958: figure 4: 85, 89). The artifacts were recovered from the museum test trench excavated from July 17th through July 19th, 1956. It is difficult, if not impossible, to establish which cultural level(s) this corresponds with, regarding the 1995 and 1996 field work, because the published information (Nero and McCorquodale 1958) describe the level as "black" but museum records state that these artifacts were recovered from a "buff" silt zone (McCorquodale 1957),

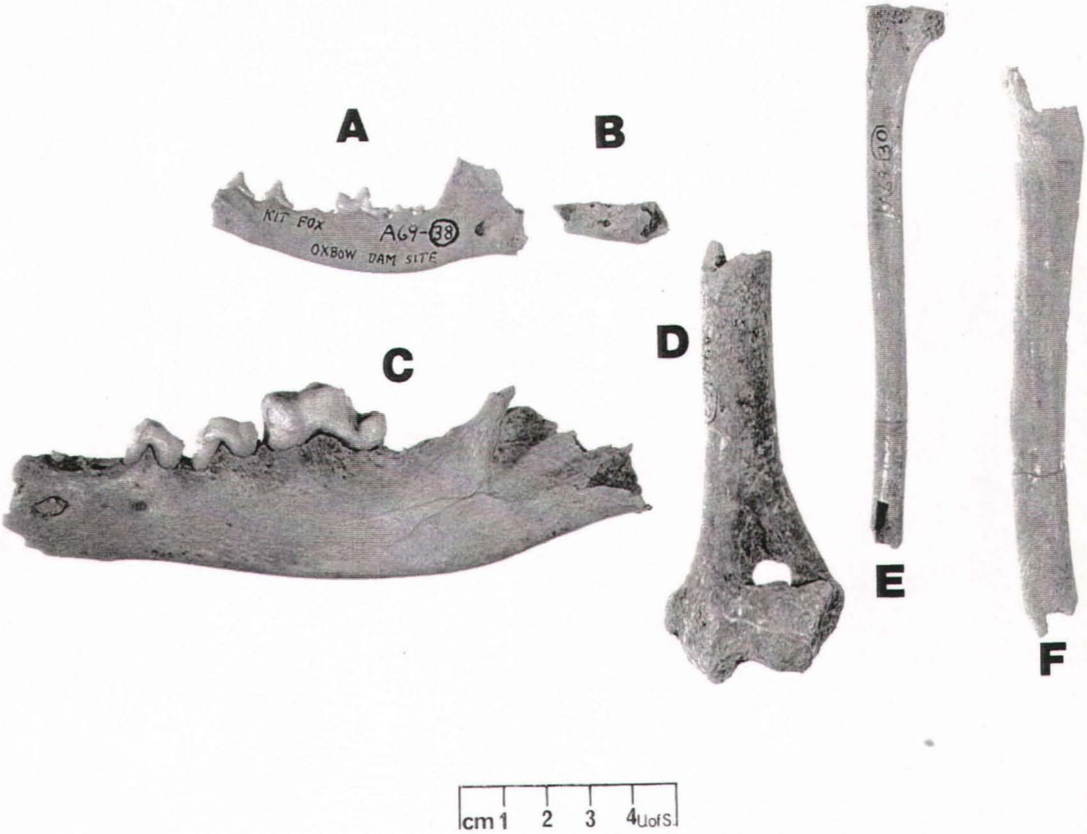


Plate 7.9: Canid remains collected from DhMn-1 in 1956. A: Kit Fox (*Vulpes macrotis*) or Swift Fox (*Vulpes velox*) right mandible ramus fragment, B: Swift Fox left mandibular symphysis, C: Wolf (*Canis lupus*) left mandible ramus fragment, D: large canid (*Canis lupus* or *Canis familiaris*) left distal humerus, E: Gray Fox (?) (*Urocyon cinereoargenteus*) left tibia, F: medium-sized canid (*Canis latrans* or *Canis familiaris*) left tibia shaft fragment.

likely thick alluvial deposits that overly the "black zone" mentioned in the publication. The black zone referred to in the publication probably corresponds with cultural level three as described in chapter five. However, during the recent excavations, some artifacts were recovered from "buff' silt associated with cultural level two. In any case, the exclusion of these artifacts from the Oxbow assemblage has little bearing on the outcome, particularly in light of the reassignment of elements identified as *Cervus canadensis* (elk) to juvenile *Bison bison bison.* It should be noted that McCorquodale's (1957: 4; Nero and McCorquodale 1958: 88-89) tentative assignment of these elements to elk was based on size in comparison to bison specimens at his disposal.

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison.* Modified MNI = 2 (based on significant size differences in second phalanges). NISP = 6.

Unburned elements include one left proximal metatarsal (15.0 g: formerly assigned to *Cervus canadensis*), one left fused second and third tarsal (3.9 g: formerly assigned to *Cervus canadensis*), one left third phalanx of medium-sized bison (23.9 g), one left second phalanx and medium-sized bison (21.1 g), one left second phalanx of large bison (36.0 g) and one right distal radius fragment of large bison (175.8 g).

7.5.6 Faunal Material Recovered from Zone II

This material is from the test trench excavated by the museum staff members R.W. Nero, B. McCorquodale, and W. Niessen, during the July 17th to 19th, 1956 visit. This level corresponds to a sand layer approximately 2.5 centimeters thick, immediately above the hearth as reported by Nero and McCorquodale (1958: 89). Zone II likely corresponds to a layer of light brown sandy silt ranging up to seven centimeters in thickness, noted during the 1995 and 1996 excavations, that was in direct contact with the top of cultural level six (Oxbow complex).

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison.*
MNI = 1. NISP = 5.
Unburned elements include one right trochlea of a metacarpal (36.7 g), one second phalanx (23.6 g), one medial fragment of first phalanx (4.4 g), one complete right lateral malleolus (11.0 g) and one posterior-lateral fragment of a right tibia (6.3 g).

Class Mammalia, Order Carnivora, Family Canidae, *Vulpes velox* (Swift Fox) or *Vulpes macrotis.* (Kit Fox). MNI = 1. NISP = 2.
Unburned elements include one right mandible horizontal ramus (4.4 g: Plate 7.9: A), and one canine tooth (0.3 g).

7.5.7 Faunal Material Recovered From Zone III

This level contains artifacts that were recovered in direct association with the hearth feature during the excavations of July 17th to 19th, 1956, as reported by Nero and McCorquodale (1958: 89).

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison.*
Modified MNI = 2 (based on significant size differences in ulnar carpals).
NISP = 29.
Unburned bison elements include one right distal lateral supracondylar fossa fragment of the femur (26.0 g), one left ulnar carpal (12.4 g), one left lunar carpal (14.6 g), one left unciform carpal (12.1 g), one left sesamoid (3.6

g), one right ulnar carpal (18.8 g), one left trochlea of a metacarpal (52.2 g), one right trochlea of a metacarpal (51.1 g), one left proximal metacarpal (40.1 g), one fragment of a trochlea of a metapodial (11.5 g), one posterior distal metatarsal (15.9 g), one left third phalanx (20.1 g), one left prezygapophysis of the seventh cervical vertebrae (18.9 g), one right lower first molar (41.6 g), one right lower incisor (4.6 g), one right lower second premolar (2.4 g), one right lower third premolar (3.5 g), one right alveolar portion of the mandible including the fourth premolar and the third molar (47.0 g), one right lateral alveolar portion of the mandible (23.6 g), one indeterminate cranial fragment (21.5 g), one right pubis of the acetabulum (25.5 g), one fragment of a stylohyoid bone, and one left inferior cranial articular fovea of the atlas (16.8 g).

Class Mammalia, Order Carnivora, Family Canidae, *Canis sp.*

MNI = 2. NISP = 3.

A medium-sized member of the genus is represented by a lower incisor tooth fragment (0.2 g) and single incomplete left tibia (14.3 g, Plate 7.9: F). These elements are in the size range for *Canis latrans* (coyote) but, the tibia is slightly more robust, with a pronounced curvature to the shaft. McCorquodale (1957: 2) noted the curvature and size of the tibia and suggested that the element may represent domestic dog. The tooth was originally reported as that of a small ungulate.

A small canid is represented by an unburned left tibia (6.7 g) which is likely that of the Red Fox (*Vulpes vulpes*). Given its small size, there is a remote possibility that it represents a Gray Fox (*Urocyon cinereoargenteus*) which may have inhabited the area in the past (Plate 7.9: E).

Class Amphibia, Order Anura, Family Ranidae.

Unfortunately, this specimen is missing from the museum collection; however, McCorquodale (1957: 3) described the specimen as "several bones of one skeleton" and further noted that the rest of the skeleton was "probably *in situ* but lost during the recovery of these bones." This suggests that McCorquodale felt that the frog was intrusive, probably representing a hibernaculum death as described by Morlan (1994 b: 138).

Phylum Mollusca, Class Pelecypoda, Family Unionidae. (Freshwater clams) MNI = 3 (based on 6 hinges). The freshwater clams from the museum collection were not thoroughly analyzed because of their extremely fragile state.

7.5.8 Artifacts from the Controlled Excavation with No Further Provenience

Although this category contains items excavated in a controlled fashion, oddly the records do not indicate which "zones" the materials came from (Nero and McCorquodale 1958). These materials include a number of specimens that were worthy of mention in the publication and it is possible that this sample simply represents material that had not yet undergone examination by the time the original manuscript was being prepared (Nero and McCorquodale 1958).

Class Mammalia, Order Artiodactyla, Family Bovidae, *Bison bison bison.*

MNI = 1. NISP = 2.

Unburned bison remains include one upper molar fragment (3.9 g), and one fragment of the petrous portion of temporal bone (0.8 g).

Class Mammalia, Order Carnivora, Family Canidae, *Canis lupus*,(wolf) or *Canis familiaris* (dog) and *Vulpes velox* (Swift Fox).
Modified MNI = 2. (based on two significantly different sizes of canid remains). NISP = 4.

Large canids (wolves or dogs) are represented by two unburned distal metapodial fragments.

Small canids (Swift fox?) are represented by one unburned left mandibular symphysis and one unburned canine tooth. The mandibular symphysis (Plate 7.9: B) is considerably smaller than that recorded from zone II as Kit Fox (Nero and McCorquodale 1958: 89).

7.6 Discussion and Results of the Re-analysis

In light of recent excavations at DhMn-1, it now seems likely that diagnostic artifacts from the museum excavation represent a mixed assemblage rather than a single component as had been thought. Although problems do exist with the data collected at DhMn-1 in 1956, the assemblage still contains a large amount of usable information on the Oxbow complex. Classes of lithic artifacts that were overlooked during the initial investigations and analyses have proven to be items familiar in many Oxbow components. Previously unrecognized lithic tools in the museum assemblage include two ovate bifaces, one wedge-shaped biface, one concave scraper, one thick sidescraper, and two coarse-grained scraping tools. One tool formerly classed as a biface (see Nero and McCorquodale 1958: 87 figure 5:M) has been included as a uniface knife here. Other alterations to original classifications include the reclassification of five items, which were formerly referred to as retouched flakes, into the category of thin uniface knives in order to maintain continuity with Dyck's (1970, 1977) classification system for Oxbow complex tools. Another four items previously referred to as retouched flakes appear to be utilized flakes. Of special concern is the classification of the projectile points within the assemblage. It is a commonly held belief that the five projectile points recovered by SMNH staff members were recovered in good context from the layer containing the dated hearth. Recently, in fact, Nero (1997: 55) has reiterated this point. However, troublesome projectile points (ie: those that do not fit into our basally-concave-side-notched understanding of Oxbow points) can be separated out with a careful read of the publication (Nero and McCorquodale 1958). Two of the points in particular, a grey chert slightly concave-based, side-notched point and a stemmed point base of Knife River Flint, can be sufficiently isolated from the three remaining points to exclude them from the assemblage. It should be noted that small, slightly concave-based side-notched points do occur in Oxbow or related complex components at other sites including level eight at the Long Creek site (Wettlaufer and Mayer-Oakes 1960) and that they these points may be a variant of the Oxbow point type. The Knife River Flint point base which is stylistically very different from the other points was found while screening backdirt left by pothunters and therefore could have come from virtually any level or any area at the site. Unfortunately, the recently recognized stratigraphic problems call into question the assignment of a finely-made clamshell pendant to the Oxbow component, although the presence of similar items in Oxbow assemblages from other sites (Millar 1978, Wettlaufer and Mayer-Oakes 1960) supports its inclusion within the complex.

Interpreting activity areas at the site based on the above sample of lithic material is somewhat tenuous as certain artifact classes are not exclusive to the Oxbow complex and may, in fact, be associated with other components. The class of thin uniface knives, for example, includes artifacts which are very similar to unifaces recovered from level four, which post-dates the Oxbow complex. Dyck (1977: 129-131) speculates that these tools functioned best as incising knives, much like a modern utility knife, rather than scrapers since drawing the working edge perpendicular to its length would have a tendency to snap the tools. As such, the knives are commonly associated with skin dressing and processing toolkits (Dyck 1977: 131). Skin working was likely one of the activities taking place at DhMn-1 during the Oxbow occupation. The high number of metapodials and phalanges represented in the museum collection may have resulted from a process where the skins were removed at the kill site with the metapodials and phalanges left intact. The elements would then be removed at the campsite where the metapodials were further processed for marrow extraction. A series of cutmarks on a second phalanx from the assemblage may attest to this procedure.

The previously unreported presence of ovoid bifaces within the museum assemblage acknowledges a class of artifacts that has been recognized in a large number of Oxbow components and Mummy Cave series components at other sites including the Harder site (Dyck 1977), the Gray site (Millar *et al.* 1972), the Connell Creek site (Meyer and Dyck 1968), levels seven and eight at the Long Creek site (Wettlaufer and Mayer-Oakes 1960) and the Gowen sites (Walker 1992), not to mention the recovery of this type of artifact during the 1995 and 1996 field seasons at DhMn-1. Of course, many complexes have forms of ovoid bifaces but Oxbow and Gowen versions are generally crudely flaked entirely by percussion, often resembling a thin expended core with one edge, usually the remnant striking platform, that has not been retouched to act as backing. Dyck (1977: 135-136) speculates that the function of these small but robust tools is related to butchering activities both at the primary processing area and at the base camp.

The large amount of primary debitage suggests that flintknapping was a common activity at the site. This is supported by evidence representing all stages of the tool manufacturing process gathered during 1995 and 1996. Such activities are typical of Oxbow and other complexes as hunting weaponry and animal and plant processing equipment was in constant need of rejuvenation. The fragmented state of projectile points within both collections further supports this claim. Evidence from both excavations at DhMn-1 indicate that Oxbow people used heat-treating as a method of improving the flaking properties of poor quality locally-available cherts.

Reclassification and clarification of provenience of the faunal assemblage from DhMn-1 has changed the interpretation of the site slightly but overall, the Oxbow subsistence strategies represented at the site remain the same. It seems reasonable to combine data collected by Lt. Inglis during his initial tests of the hearth feature and data collected from zone III by the museum. Zone two may belong within this data set as well but it will add little to the interpretation and consequently it has been excluded. A revised list of faunal remains from the Oxbow component include one large , one medium and one small (juvenile) bison, one wolf, one coyote-sized canid (cf. dog), one small canid (cf. Red Fox), three freshwater clams, and possibly one frog. The remains of two other small foxes (Kit Fox or Swift Fox) could not be conclusively linked to this occupation and may be related to cultural level five (Hanna complex). Some differences in preservation were noted within the specimens attributed to the Oxbow component which may indicate that bone elements from cultural level seven, below the hearth feature as determined by the 1996 excavations, have been inadvertently included. In particular, several bone elements including bison phalanges and a large atlas vertebrae excavated in 1956, show an exceptional state of preservation, better than level six bone but similar to cultural level seven bone. Nevertheless, material excavated from the hearth feature by museum staff members indicate that Oxbow people relied on more than just bison for subsistence. The clam and canid remains likely represent food sources while descriptions of the frog as a "partial skeleton" (Nero and McCorquodale 1958: 88, McCorquodale 1957: 3) suggest that it was likely intrusive. The frog remains do, however, serve to indicate the care with which the museum workers excavated. Such tiny remains are easily overlooked, particularly in a mass of flakes and bone, even when excavation is accomplished using a trowel.

One aspect of the museum faunal assemblage that stands out in comparison with the recently excavated material is the very small percentage of burned or even charred bone within it. The only burned bones within the entire museum collection are a bison sesamoid, a bison astragulus fragment and a few fragments of unidentifiable bone, all of which were collected by Lt. Inglis. This is particularly odd considering that the material was collected in direct association with a hearth feature. It is starkly contrasted with the recently excavated material where 33.3% of all bone and 42.9% of the identified bison remains were burned. This may be more of a reflection of the collection techniques of the day, rather than a difference in activity areas within the larger site. However, a discrepancy within the documentation makes this possibility difficult to assess. Museum records (Nero 1956) note that the "hearth layer was covered with a large quantity of fragments of buffalo bone, some of which was collected," while published information states that "all of the bones, whole or fragmentary, that were recovered as a result of the Museum test were catalogued as to level and retained for detailed examination" (Nero and McCorquodale 1958: 88). It may be that very little burned bone existed in the area of the hearth feature and that two granitic cobbles described as "anvils" by Lt. Inglis (Nero and McCorquodale 1958: 85, and Appendix B) during his mid-July test, were used for smashing marrow-rich elements which were then discarded elsewhere or tossed over to another area for grease extraction. The broken articular ends of long bones that are present are consistent with marrow and grease extraction procedures as described by Binford (1981) and documented at other sites (Brumley 1975, Dyck 1977, Walker 1992).

This brief re-examination of the 1956 museum assemblage from DhMn-1 has resulted in the recognition of several classes of artifacts not previously recorded for this collection but recognized from a number of Oxbow components across the Northern Plains. The original assemblage demonstrates the homogeneity characteristic of the complex, while also demonstrating regional variability. Slight changes in the identification of animal species represented and alterations to the categorization of tools within the assemblage has been possible because of access to a larger body of background information and supporting documentation and in no way should reflect poorly on the museum staff members or the discoverer of the site. Likewise, discrepancies in the stratigraphic profiles between the museum excavation and the latest research were the result of compression due to slumpage in the 1956 test trench similar to the compression noted at the south end of the 1996 excavation block where several levels merged into one indistinguishable mass. As was discussed in chapter five, the original radiocarbon date may have been contaminated by one of several means and, in light of stratigraphic evidence and two new radiocarbon dates, it has been disregarded here.

CHAPTER EIGHT

OVERVIEW OF THE OXBOW COMPLEX

8.1 Introduction to the Overview:

It seems that confusion over what the Oxbow complex is comprised of began at its very inception. It is likely that a combination of contaminated radiocarbon dates and mixed assemblages from DhMn-1 led to an initial false impression of what Oxbow was. This, in turn, led Wettlaufer (1960a and b) to merge two closely related, but distinct, cultural assemblages from the Oxbow Dam site (Nero and McCorquodale 1958) and the Long Creek site (Wettlaufer and Mayer-Oakes 1960) in order to define the 'Oxbow Culture'. Part of what made the assemblages appear similar was the fact that they both contained side-notched projectile points that predated any others found in Saskatchewan by at least a thousand years, establishing a new and significantly earlier entry date for this form of technology. The differences between the museum assemblage from DhMn-1 and the Long Creek site assemblages later became fairly significant as the definition of the Oxbow complex evolved and it appeared that neither assemblage contained projectile points that are typical of the Oxbow complex. Consequently, many archaeologists do not consider the first two "Oxbow" assemblages ever excavated to even be of the Oxbow complex, while others accept one but not the other. This is the nature of advancing archaeological research and is an inherent part of the recognition and establishment of new complexes. As more data is gathered, refinements are made to established ideas about the complexes and changes in their interpretation occur. When Wettlaufer (1960a) defined the Oxbow complex, he did so based on apparent *similarities* between two assemblages. Subsequent research has focused on *differences* between the same two assemblages in order to refine the chronology and the main difference, in this case, is projectile point morphology. However, in order to study the possible origins of the Oxbow complex, the analysis of similarities between distinct complexes must be performed to find potential antecedents. First, and foremost on the list of possible candidates for assemblages which appeared to represent 'proto-Oxbow' was the original Oxbow Dam site material (Nero and McCorquodale 1958), largely due to its general acceptance as among the oldest sites to contain Oxbow-like material. The current study has had the unique opportunity to revisit the Oxbow Dam site and gather new raw data to aid in the reinterpretation of the original assemblage. The findings of this study are presented in this chapter in relationship to previous research on the Oxbow complex. Although differences exist between various assemblages, most of those analyzed conform to an emergent pattern based on subsistence adaptation as reflected by the palaeoenvironment, the functional aspects of toolkit assemblages, feature analysis and the probable hunting strategies evidenced by culturally modified faunal remains. These similarities are the common link between local Mummy Cave series complexes and the Oxbow complex. The chapter is presented in roughly chronological order to illustrate the evolution of ideas regarding Oxbow.

8.2 Initial Oxbow Studies

Although the Oxbow Dam site (DhMn-1) excavated in 1956 is generally regarded as the type site for the complex (Nero and McCorquodale 1958), no formalized definition was proposed until supporting data was recovered from the Long Creek site in 1957 (Wettlaufer and Mayer-Oakes 1960). Interestingly, Nero's and McCorquodale's (1958: 85-87) description of the projectile points from the Oxbow Dam site notes basal thinning, side-notching and notch-grinding on some of the points, but does not mention the concave base which is now considered the hallmark of the Oxbow complex. Several types of artifacts described in the original Oxbow Dam site publication (Nero and McCorquodale 1958) have become strongly associated with the Oxbow complex based on materials recovered at other sites. Included in the original DhMn-1 assemblage are thin unifacial knives, sidescrapers and endscrapers, a possible Hanna point base, two basally-concave side-notched points typical of the Oxbow complex, one Swan River Chert point which exhibits a nipple-like tip typical of the complex (Dyck 1977: 73) and one small side-notched projectile point with basal thinning and a fairly straight base that is atypical of Oxbow assemblages. The assemblage also includes a drilled, polished and ochre-stained clam shell gorget fragment, a class of artifact that has been recovered from other sites of this complex. Reported for the first time here are ovoid bifaces, concave scrapers and large, robust endscrapers which were separated from debitage during the re-analysis. Most of the artifacts are made of reasonably local lithic materials including Swan River Chert, quartzite, fused shale and Knife River Flint. The context of all of the artifacts has been questioned somewhat based on recent work conducted at the site which indicates that more stratigraphic levels exist than were originally observed (Nero and McCorquodale 1958) and that museum staff members may have inadvertently excavated in a severely slumped area with deformed stratigraphy which potentially resulted in the mixing of several components. As discussed previously, the museum radiocarbon date (S-44: cal 6177 [5947] 5769 BP: Morlan 1993) is considered unreliable because of contamination problems. Issues associated with radiocarbon dating composite samples and humic samples have been discussed in chapter seven. The potentially erroneous date still stands among the oldest commonly accepted dates for Oxbow complex material and has been extremely influential in the study and interpretation of Oxbow and Mummy Cave series assemblages throughout the Plains.

The list of fauna collected during the 1956 excavation at DhMn-1 (Nero and McCorquodale 1958) has frequently been unjudiciously referenced and reproduced for the presence of bison, coyote, kit fox, wolf, wapiti, frog and freshwater clams, without noting that McCorquodale's (1957) identifications of wapiti, wolf, coyote, and frog were not conclusive nor that the specimens were from several levels. The latter is definitely the larger of these two problems as it supports the notion that many archaeologists believed that the DhMn-1 assemblage was single component, when in fact, it was not. Specimens were "tentatively identified" as wapiti because they were smaller than bison comparative specimens available at the time (Nero and McCorquodale 1958: 88, McCorquodale 1957) and not because they matched a wapiti comparative specimen, hence the question marks following each tentative identification in the 1958 publication (Nero and McCorquodale 1958: 89). Subsequent research has generally supported the notion that Oxbow people exploited these species, but conclusive evidence did not come from the Oxbow Dam site.

Wettlaufer (1960a) recognized similarities between projectile point technology and radiocarbon dates from levels 7 (S-50: cal 5720 [5317] 4869 BP; Morlan 1993) and 8 (S-52 and 53: cal 5567 [5319] 5054 BP; Morlan 1993) at Long Creek and points and a radiocarbon date from the Oxbow Dam site, excavated a year earlier. He later noted (Wettlaufer 1981: 79-80) that Oxbow projectile points were a familiar item to collectors, who referred to them as "Dog-eared" or "Dakota" points, well before the excavations at either of the aforementioned sites. Undoubtedly, he had seen such projectile points while conducting extensive surveys of collections from within the southern portion of the province for the Saskatchewan Museum of Natural History during the early 1950's. Wettlaufer may have started to formulate ideas about the complex shortly after encountering the material from the excavations at DhMn-1 while at the museum. It would have been very difficult to make any generalizations based on the DhMn-1 assemblage alone, but, it would have provided some contextual information, such as an approximate age, for the artifacts in collections throughout the province. The subsequent excavation of a large sample of similar materials at the Long Creek site (DgMr-1) resulted in the formal definition of the Oxbow "Culture" (Wettlaufer and Mayer-Oakes 1960). Ironically, as mentioned above, many archaeologists (Reeves 1973, Quigg 1984, Meyer 1981b, Walker pers. com.) do not consider the artifacts from level 8 at Long Creek to be typical of the Oxbow complex as it is currently understood. This position is also followed here. The various classes and forms of tools recovered from levels 7 and 8 at Long Creek include basally-thinned, side-notched projectile points with slightly incurved bases, small straight-based triangular points, larger triangular points with incurved bases, "ovoid", "elongated" and "tapered blades" (bifaces), thin sidescrapers, concave scrapers, triangular endscrapers (unnotched), chipped stone awls and associated bone tools and flake tools (Wettlaufer 1960b).

The most common form of projectile point in the Long Creek assemblage for level 8 is a relatively large triangular point with slightly excurvate lateral blade margins, wide shallow side-notches and a thinned, slightly concave base (Wettlaufer and Mayer-Oakes 1960). These points have generated some controversy and according to the current study, are viewed as very closely related to, but distinct from Oxbow points. Reeves (1973: 1245) noted a strong similarity between these points and Bitterroot or Salmon River Side-Notched types of the Mummy Cave series. Similarly, E.G. Walker (pers. com.) notes similarities to Gowen points, also of the Mummy Cave series. Some confusion as to the cultural affiliation of the points may be due to the method of illustration used in the original monograph (Wettlaufer and Mayer-Oakes 1960). Some of the points from the Long Creek site level 8 are rather poorly portrayed in the original monograph and have been rephotographed and illustrated in this volume (see chapter four Plate 4.2). A common practice of the time was to cut the artifact out of the photograph in order to place the image on a pure white background. Unfortunately, this process can also change the silhouette of the artifact considerably as is the case for several of the projectile points in plate 18 of the Long Creek site volume (Wettlaufer and Mayer-Oakes 1960: 58). Projectile point numbers 1, 4, 6, and 7 were significantly altered during this process, particularly in the basal and notch areas which are considered diagnostically important. For example, point number 4, plate 18 is portrayed with a straight base. This is virtually impossible to determine as all of the basal margin is broken off.

Other varieties of points and bifaces also exist in the assemblages. Wettlaufer (1960b: 52-55) did not distinguish large symmetrical hafted bifaces from projectile points although some more recent publications separate them into an unique class because of their size (Dyck 1983: 96-98, Millar *et al.* 1972:20). Unnotched, straight-based and unnotched, concave-based projectile points are less frequent but do not appear to be intrusive. The amount of basal grinding is relatively variable ranging from grinding across the entire base and notch area on most basally-concave side-notched points to no visible grinding on small unnotched points. Wettlaufer (1960b: 56-57) clearly felt that basal thinning, as opposed to the presence or absence of a concave base, was the common denominator that tied all of the forms of projectile points from these levels at Long Creek and the Oxbow points from DhMn-1 together.

A class of artifacts that Wettlaufer referred to as "blades" (1960b: 55, 59-61) is represented by an assortment of bifaces which range from carefully formed parallel-sided "elongated blades" and tabular convergent-sided "tapered blades" to bifacially flaked ovoid knives and minimally retouched flakes. The elongated and tapered bifaces are thin, percussion flaked implements while the ovoid blades are much thicker and reminiscent of spent cores in many respects. Ovoid blades tend to be completely shaped by the removal of large flakes in several directions resulting in a rugged and effective cutting tool. These tools have recently been identified in the original museum assemblage from DhMn-1.

Side scrapers, concave scrapers and endscrapers were the predominant tools in cultural level 8 but rare in level 7 (Wettlaufer 1960a: 110). Wettlaufer (1960b: 57) noted that the endscrapers were of two varieties, one with the dorsal surface completely worked to form a longitudinal ridge down the center and another with lateral edges worked at a steep angle resulting in a flat dorsal surface which may exhibit a remnant longitudinal flake scar. Endscrapers may be stubby in appearance or elongated. Wettlaufer (1960a: 110) saw strong similarities between scrapers and bifaces recovered from level 6 with materials in levels 7 and 8 and it seems he felt that the notched scrapers within level 6 would later prove to be diagnostic. Sidescrapers are described as relatively common items made by unifacially retouching one or more longitudinal edges of a flake. Similarly, concave scrapers and chipped stone awls are described as flakes which have been retouched to create in-curved working edges, the latter having two concave scraping surfaces on opposing sides of a spike.

Sixteen bone items from levels 7 and 8 were described as tools by Wettlaufer (1960b: 63-65). It now seems likely that the several of these items are not the work of humans but, instead, the result of carnivore activity although only a rudimentary re-examination of these artifacts has been conducted. Research by Binford (1981) has shown that the breakage patterns, polishing and flaking of bone that were once thought to be exclusively the work of humans are attributable to gnawing behavior by animals ranging from canids to voles. This is particularly true for items referred to as beaming tools and spatulas at both the Long Creek site (Wettlaufer and Mayer-Oakes 1960) and the Oxbow Dam site (Nero and McCorquodale 1958). Many of these artifacts show the unmistakable pitting, puncture marks and flaking associated with gnawing by canids. Although no full-scale analysis was made of these items during this study, rudimentary examination suggests that only the items referred to as bone awls are of human manufacture.

Based on their research at Long Creek and contemporary studies in the midwestern United States, it seems that both Wettlaufer (1960a: 112) and Mayer-Oakes (1960a: 117, 1959) felt that the origins of the complex were to the south and east where side-notched projectile points were of much greater antiquity. Since 1960, the definition has been refined and developed in a number of different directions.

A work by Wormington and Forbis (1965) entitled *An Introduction to the Archaeology of Alberta, Canada,* which contained overviews of many important archaeological sites in the prairie provinces and adjacent states, appears to have been influential in subsequent investigations of Oxbow components. Shortly after the work at Long Creek and Oxbow Dam was published, Wormington and Forbis (1965: 52) chose to broaden the concept of the "Oxbow Culture" (Wettlaufer 1960a) to the "Oxbow Complex." The term 'complex' is used to imply that a number of cultural groups could have used the same forms of tools and subsistence adaptations within a given region and time span (Dyck 1983: 69). In a synopsis of the Oxbow Dam site excavations, Wormington and Forbis (1965: 49) added that Oxbow points could be distinguished from later side-notched points because of their "excessive thickness" and the relatively wide space between the notches, reportedly 12 - 13.5 mm, suggesting that the points were hafted to a heavy shaft. Incidentally, this measurement was significantly smaller than those made on specimens from Long Creek, which averaged 18 mm from notch to notch (Wettlaufer 1960b: 56). Most important, however, was their description of points and artifacts from the Castor Creek site (FbOw-01) located 130 km east of Red Deer, Alberta (Wormington and Forbis 1965:113-116). Illustrations and descriptions depict Oxbow projectile points with side-notches, evidence of basal thinning, and "deeply indented bases that produce an eared effect" (Wormington and Forbis 1965:116). This may be the first published use of the term 'eared' in describing Oxbow projectile points although MacNeish (1958: 100) had previously used this term to describe similar items referred to as Parkdale Eared points of the Larter Focus from Manitoba. These may, in fact, be the same point style (Saylor 1979: 50). The drawings from Wormington and Forbis (1965: 115) of the Castor Creek points certainly represent what was to become the quintessential Oxbow point to all students of Northern Plains archaeology even though they varied considerably from the Long Creek level 8 points that were used to define the complex. Unfortunately, the manuscript (Wormington and Forbis 1965: 52) contained misrepresentations about the Oxbow complex, not the least of which was that the defining projectile points from level 8 at the Long Creek site were only three-quarters of an inch (20 mm) long when, in reality, the average length for the level 8 points is twice that.

This may have been a turning point in the study of the Oxbow complex. Through the mid 1960s and early 1970s the numbers of reported

Oxbow components rose steadily. It was at this time that Reeves (1973:1245) noted that confusion existed regarding Oxbow complex assemblages. In speculating about the origins of the complex, he noted that two distinct developmental periods existed within Oxbow. During an initial period (5700 BP and 5300 BP: based on calibrated versions of Reeves' estimates of 3000 B.C. and 2600 B.C.), Oxbow components occasionally contained projectile points which he considered to be part of an earlier complex in the Mummy Cave Series (Reeves 1973: 1245). As examples of this, Reeves noted that the projectile points in level eight at Long Creek (Wettlaufer and Mayer-Oakes 1960) and those from the 1956 DhMn-1 assemblage (Nero and McCorquodale 1958) included variations of either Bitterroot or Salmon River Side-Notched types which had a wide distribution between Idaho and Minnesota. Later Oxbow assemblages (5300 - 4400 BP: based on calibrated versions of Reeves' estimates of 2600 B.C - 2000 B.C.) contained only what Reeves referred to as "Classic" Oxbow points which exhibit side-notches in conjunction with a deeply concave base creating an 'eared' or 'lugged' appearance, as described by Wormington and Forbis (1965). For a more extensive list of radiocarbon dated Oxbow components see Appendix A.

8.3 Oxbow Research During the 1970, 80s, and 90s

Perhaps the most comprehensive work on Oxbow complex campsites is Dyck's (1977) publication on investigations at the Harder site, a winter campsite in the Dunfermline Sand Hills west of Saskatoon. The Harder site (Dyck 1970, 1977; Morlan 1994a) is exceptional in that it is located in a sandy area approximately 20 km from the nearest source of fresh water. Dyck (1977) focuses heavily on the technological aspects of the complex including thoroughly researched discussions of the "life stages" of lithic and bone tools from functions and manufacturing sequences to breakage patterns to rejuvenation and eventually, abandonment. He notes that the fragmented projectile points and end scrapers at Harder represent discarded items suggesting that activities surrounding toolkit rejuvenation must have occurred. Lithic debitage concentrations indicate that portions of the site appear to have functioned as flintknapping work stations. The author created a classificatory system for Oxbow complex tools using the large Harder site assemblage and tested the system using smaller assemblages from both excavated contexts and surface collections within Saskatchewan (Meyer and Dyck 1968, Dyck 1972, Wettlaufer and Mayer-Oakes 1960). Among other things, he was able to determine that Harder site Oxbow points occasionally retained evidence of a striking platform on the basal portion of a lug or ear (Dyck 1977: 80). This suggests that the subsequent removal of a large amount of material known as the bulb of percussion would have been necessary in order to thin the point to facilitate hafting, something that is much more easily accomplished when the thin, distal end of the flake blank is used as the base. It should be noted that the reduction sequence identified by Dyck (1977: 80) does not appear to have been practiced by all Oxbow groups. Greiser *et al.* (1983) depict a slight variation in the sequence based on artifacts recovered from the Sun River site near Great Falls Montana, where the distal portion of the primary flake blank becomes the basal portion of the finished projectile point. Dyck's metric analysis and descriptions of Oxbow projectile points elaborated on themes first presented by Nero and McCorquodale (1958) and Wettlaufer and Mayer-Oakes (1960). He describes the silhouette of the point as a symmetrical "elongated teardrop" with a basal concavity and side-notches, which often terminates in a "nipple-like point" (Dyck 1977: 72-73). The shallow notches are always near the bottom of the lateral edges, often at the widest portion of the blade. They are roughly twice as long as they are deep and may be simply crushed into thin segments of the blade rather than pressure flaked, thereby eliminating the need for subsequent grinding. The majority of the points analyzed did, however, reveal intentional edge grinding. Dyck (1977: 74) notes that the basal margins exhibit varying degrees of inward curvature from an almost straight basal margin, to those with depths equal to about one-quarter the length of the curve.

Twenty-two artifacts closely resembling the unnotched points from Long Creek were recovered at the Harder site as well. Dyck concluded that these items were likely Oxbow point preforms although others, such as Wright (1995: 303), question this conclusion suggesting that these artifacts may represent a variant of the Oxbow point style which used a different hafting technique. However, the lack of grinding on these points, as exhibited at Long Creek (Wettlaufer 1960b) suggests that they are unfinished. An example of one such item was recovered during the 1996 field season at DhMn-1 and is clearly an unfinished projectile point preform. It seems logical that flintknappers would finish every aspect of the projectile points except for the notches, which would be made in accordance with a specific shaft when hafting activities were to be undertaken. Other chipped stone artifacts from the Harder site include small endscrapers, unifacial and bifacial knives, perforators and retouched flake tools. Many of the "small" end scrapers were, in fact, tiny with an average length of under 2 cm (Dyck 1977:116). Upon completion of his analysis Dyck (1977: 201) concluded that the Harder site tools represented "broken, worn out, and unfinished" items typical of campsite localities where hunting weaponry, and implements used in hide processing would have been repaired or replaced.

Spatial analysis at the Harder site revealed what appeared to be dwelling floors based on small concentrations of artifacts, ash, and general areas of stained, carbonaceous soil. Dyck (1977: 194) suggests that at least one of the proposed dwellings used at the site was a circular unit at least 6 meters across possibly made from hide, or bark. No posthole molds or stone alignments were noted during the excavation so the exact nature of these dwellings is speculative. One feature contained a concentration of unburned pulverized bone, much of which was identified as representing bison forelimbs from the proximal humerii to the distal phalanges. This was interpreted as a discarded batch or batches of boiled bone from grease extraction activities although no boiling pits were uncovered during the excavation (Dyck 1977: 179-180). Morlan (1994a) has recently re-examined the faunal remains from the Harder site and concluded that activities such as soup preparation, meat boiling, and marrow recovery would have produced similar patterns without wasting water. The nearest supply of fresh water for the Harder site is apparently 20 km away and Dyck (1977: 199) speculated that water could have been collected as snow and ice. Acton and Ellis (1978: 5, 65) indicate that sandy deposits, which characterize the Dunfermline Sand Hills, are primarily classified as Orthic Regosols with no external drainage. They further note that such areas may contain regions of Saline Orthic Regosols in low areas. While these soils are extremely permeable, subsoils may be impervious, causing a high water table. Soils classed as poorly drained may hold standing water as high as 30 cm below the surface (Acton and Ellis 1978: 142). It seems possible then, that even sites as far from surface water as the Harder site could be occupied throughout the year if groundwater resources were exploited. Interestingly, Meltzer (1991) reported on the utilization of excavated wells in response to a drop in the water table during the Altithermal at Mustang Springs in Southern Texas. While no direct link is proposed between the Northern Plains Oxbow complex and Southern Plains Altithermal complexes, the example is presented to illustrate that such practices existed during pre-Oxbow times and therefore may have carried over into that period.

Morlan's (1994a) re-examination of bone from the Harder site led to several significant changes in the interpretation of faunal remains from all cultural periods as well as contributing three new radiocarbon dates for the site. Dyck's (1977) original radiocarbon dates were processed using insoluble bone collagen from a composite sample of charred, comminuted bone. These samples yielded two dates, S-668 cal 4148 [3833] 3479 BP and S-490 cal 4126 [3803, 3798, 3717] 3403 BP. At the time, these dates were fairly young for Oxbow materials in comparison with the museum date for DhMn-1 (Nero and McCorquodale 1958) with an age of S-44: cal 6289 [5947] 5655 BP (Morlan 1993) and level 8 at Long Creek (Wettlaufer and Mayer-Oakes 1960) with an age of S-52 and S-53 average: cal 5567 [5319] 5054 BP (Morlan 1993) but were somewhat comparable with material dated from another nearby Oxbow component named the Moon Lake site (Dyck 1970), dated at S-403: cal 5033 [4827] 4444 BP and the Carruthers site dated at S-742: cal 3624 [3376] 3156 BP. Morlan's (1993, 1994a) new dates were processed on solubilized bone collagen using single elements or large portions of not more than two elements within a given sample. The dates include one sample that is remarkably close to Dyck's (1977) dates for the Harder site assemblage at S-

3453: cal 4239 [3841] 3474 BP and two others that are considerably older at S-3444: cal 5585 [5255, 5180, 5132, 5110, 5068] 4736 BP and S-3452: cal 5257 [4865] 4645 BP. This suggests that the site may have been occupied twice approximately 1000 years apart or that one set of dates was somehow contaminated. Morlan hypothesized that a groundwater discharge~recharge system, active in the area, may have differentially affected the bone, resulting in marked differences in determined ages which only increased with calibration (see Appendix A for calibrated and uncalibrated dates).

The Moon Lake Site (Dyck 1970) is located along the western edge of an abandoned channel of the South Saskatchewan River near Saskatoon. Like Harder, Moon Lake is situated in an area of sand dunes which extend for several kilometers west, north and northeast of the site location. The dunes end approximately 250 meters southeast of the site at the edge of the channel. The channel currently contains a small oxbow pond referred to as Moon Lake (Dyck 1970: 9). The artifacts recovered from the site include notched and unnotched basally concave projectile points, a flake perforator, a large ovoid biface, small bifaces, numerous large and small end scrapers, and other unifacially retouched items. Identified faunal remains include bison and goose. Activities at the site reflect the processing of a small number of bison and some evidence exists for manufacturing or maintaining stone tools. A row of postholes near a hearth feature was interpreted as a possible wind break (Dyck 1970: 10). Dyck (1970: 16) suggests that the season of occupation was likely spring or fall based on the presence of goose remains, taking into consideration the migratory schedule of these birds. As mentioned above, the calibrated age for Moon Lake is S-403: cal 5033 [4827] 4444 BP.

The Connell Creek site (Meyer and Dyck 1968) is a surface collection of typical Oxbow complex material from east central Saskatchewan east of the town of Carrot River. On the eastern edge of the site is a shallow depression which fills with water during wet springs. The west bank of Connell Creek is approximately 200 meters east of the find spot; however, an abandoned meander scar indicates that the channel may have flowed somewhat closer to the site at the time of occupation (Meyer and Dyck 1968: 2). The authors illustrate and describe three basally-concave, side-notched Oxbow points, one poorly made unnotched projectile point which descriptively fits into the category of Oxbow preforms, three large basally-concave, side-notched hafted bifaces, several ovoid bifaces, one small hafted ovoid biface, eight concave scrapers, and numerous end and side scrapers (Meyer and Dyck 1968: 4-8). All of these lithics appear to have been made of locally available cherts, agates and possibly siltstones. The assemblage is consistent with a number of Oxbow component assemblages from the province and does not appear to include any intrusive material. Therefore, it seems likely that the Connell Creek site (FhMu-1) represents a single component Oxbow campsite where activities including lithic tool production took place. Meyer and Dyck (1968: 2) suggest that the site may have been occupied during more arid times as it is situated in a poorly drained area with little wind relief from mosquitoes. Conversely, the site could have been a winter occupation in what was a wooded area with substantial reserves of fuel and shelter. Unfortunately, very little bone survives in the boreal forest soils of the Connell Creek site and, consequently, no faunal analysis was reported.

Amundson (1986) reported a series of stratified Oxbow complex components at the Amisk site in Wanuskewin Heritage Park near Saskatoon. The Amisk site (FbNp-17) is located along Opimahaw Creek, a small tributary of the South Saskatchewan River. Within the multicomponent site, the researcher identified two components containing Oxbow projectile points and a third which contained no diagnostic artifacts but produced a radiocarbon date within the accepted range for the Oxbow complex. Level four, the uppermost Oxbow component produced seven projectile points, six of which were complete enough to be designated as Oxbow. One of the points has only a slightly concave basal margin and wide, shallow side-notches but exhibits basal thinning with the removal of several flakes (Amundson 1986:129, 130). Also in the assemblage is a preform, which Amundson (1986:131) suggests was discarded because of its excessive thickness and the flintknapper's inability to successfully thin the object. Other items from level four, which are common to Oxbow assemblages, include three endscrapers, two sidescrapers (one of which was made from a fragment of an ovate biface), and various retouched flake tools and cores. The material types are primarily locally available cherts, quartzites and jaspers, although some exotic materials including Knife River Flint and welded volcanic tuff were also used. The faunal assemblage includes bison, canid, beaver, clam and, reportedly intrusive, ground squirrel (Amundson 1986:134). As with almost every recorded Oxbow site, bison appears to have been the main food source, represented by a minimum of four individuals, followed by smaller percentages of canid, clam and beaver. At Amisk, however, the representation of identified clams (12 valves) is relatively high and supports the idea of Oxbow people as opportunistic and highly adaptable. The preponderance of freshwater clams, as a food source, items of personal adornment and utensils, at this and other Oxbow sites indicates that the complex was well adapted to riverine environments. The bison elements represented suggest that they were killed elsewhere and that only portions of the carcasses were brought to the habitation site for further processing. Level four produced a radiocarbon date of S-2536: cal 5294 [4805, 4767, 4639, 4637, 4614, 4581, 4578,] 3997 BP. Level five at the Amisk site produced only a few chipped stone tools, including two fragments of ovate bifaces, one fragment of an Oxbow projectile point base, one endscraper, one chopper made on a very large quartzite flake, and one combination hammerstone~anvil. As with level four, the faunal assemblage consisted of bison, canid, ground squirrel, and clams. Again, Amundson (1986: 49) considers the ground squirrel remains to be intrusive. A hearth feature, concentrations of fragmented bone and bones exhibiting cutmarks suggest that bone processing activities involving marrow and grease extraction were taking place at the site during this occupation (Amundson 1986: 156). Level five produced a radiocarbon date of S-2535: cal 5442 [4832] 4231 BP. Cultural level six at Amisk contained a tapered and highly polished bone awl made on a splinter similar to examples from level eight at the Long Creek site (Wettlaufer and Mayer-Oakes 1960: 62). Faunal remains were limited to bison with a minimum of two individuals being represented. While no diagnostic artifacts were recovered, a radiocarbon date of S-2534: cal 4859 [4361] 3739 BP (Morlan 1993) is suggestive of an Oxbow occupation.

The Hacault site (DkLm-1) is a recently reported Oxbow campsite near Elm Creek in southern Manitoba (Nero 1997). The assemblage consists largely of surface-collected items from a blowout in a sandy area several kilometres from the nearest fresh water. Like the Harder site, Hacault is near a large depression thought to have once held water. Artifacts recovered from the site include complete and fragmented portions of 60 projectile points, 22 of which are typical Oxbow points, 52 biface fragments, 14 complete bifaces, 61 endscrapers, 45 sidescrapers, 23 preforms, 15 wedges or cores, and 6 perforators as well as over 8000 flakes and several faunal specimens including wapiti (Nero 1997). Nero (1997) and an assistant conducted subsurface tests at the site and recovered enough bone to obtain two radiocarbon dates from Brock University, one of which (BGS-1717: cal 4982 [3470] 2125 BP) was rejected because of heavy mineralization (Nero 1997: 53) while the other was considered reliable (BGS-1753: cal 3558 [3243, 3233, 3217] 2850 BP). This date is very young for Oxbow material but fits a pattern of relatively recent Oxbow sites in eastern regions. Illustrations depict what appear to two Larter Tanged projectile points (MacNeish 1958; Dobson 1994) within the collection. Larter Tanged projectile points were first recognized in the 1950s (MacNeish 1958) and are thought to be contemporaneous with late McKean variants or younger point styles (MacNeish 1958: 100-101; Syms 1980: 131). Nero (1997) draws attention to several parallels with the Harder site (Dyck 1977; Morlan 1994a) regarding overall setting, the range of tools within the assemblage and the extent to which the tools had been reworked. Based on the presence of fragmented bone, fire-cracked rock, anvil stones, hammerstones and the large number of discarded broken tools, he suggests that the major activities occurring at the site were likely bone processing, and lithic tool rejuvenation and manufacturing (Nero 1997). Furthermore, the lack of any nearby fresh water seems to suggest that, like Harder, the occupants may have relied on snow and ice for water; therefore, the implication is that the site is a winter occupation (Nero 1997: 62). Other sites recorded from Manitoba include the Cherry Point site (Haug 1976) which seems to have problems involving mixing as well as dating. Buchner (1979: 31-32, 80-86) notes another Oxbow association at the Whitemouth Falls site near the confluence of the Whitemouth and Winnipeg Rivers from a level radiocarbon dated to GAK-4248: cal 6170 [5724] 5323 BP and GX-4416: cal 5889 [5565, 5540, 5474] 4985 BP.

Vickers (1986) notes that excavated Oxbow components are a rarity on Plains of Alberta. One exception is the Southridge Site located near the city of Medicine Hat (Brumley 1981 as cited by Vickers 1986:66). The site assemblage contains seventeen Oxbow points, three unnotched triangular points, two endscrapers, twenty-three bifaces, four unifaces, and sixty-eight marginally retouched flake tools. The majority of the tools are made from locally available lithic materials although a small percentage of exotic material is included. Brumley (1981: as cited by Vickers 1986) identified two areas where bone grease and marrow extraction activities occurred, each containing a hearth and boiling pit and large amounts of fire-cracked rock. The remains of two bison were recovered including a relatively old individual which prompted Brumley to suggest that bison resources may have been scarce at the time of occupation. The site has been radiocarbon dated to RL-1534: cal 5315 [4847] 4413 BP and RL-1535: cal 5453 [4967, 4939, 4876] 4533 BP.

A multicomponent Oxbow complex site has been identified on a floodplain of the Sun River near Great Falls Montana (Greiser *et al.* 1985) The Sun River site components are interesting in that they exhibit characteristics which are very typical of Oxbow components within

Saskatchewan but also appear to include regional variation with more universal traits. Geographically, the Sun River site is situated adjacent to the Northwestern Plains in the Middle Rocky Mountain physiographic area (Greiser *et al.* 1985: 849). The site has been extensively dated with eleven radiocarbon assays from three Oxbow components. The radiocarbon dates suffer because of very large standard deviations which can create an age range at two sigma that differs by as much as 1700 years on a single sample. Generally the dates are older than many Oxbow materials on the Plains; however, they are comparable to several of the dates from the Gray site in Saskatchewan which will be briefly discussed below. Greiser *et al* (1985) report that the uppermost Oxbow level (cultural level four) contained five Oxbow projectile points, three preforms, nineteen unifaces, nine biface blanks, one bone awl, and a possible roasting pit in association with a radiocarbon date of Beta-5536: cal 4809 [3691] 2819 BP. Many of the lithic tools appear to be fragmentary and/or worn out. Lithic materials included cherts, chalcedonies, agates, quartzites and other materials that are reportedly available in local glacial deposits (Greiser *et al.* 1985: 859). Faunal remains recovered from the level suggest a heavy reliance on bison but include specimens of pronghorn, fox, rodents, gastropods, pelecypods, rabbits or hares, and fish or amphibians. The authors state that all species except the gastropods and, perhaps, the fox and pelecypods, were probably utilized as food resources (Greiser *et al.* 1985: 857). Greiser *et al.* (1985: 859) suggest that the occupants during this period were camped along the edge of a slow meandering stream or oxbow lake exploiting mammals and aquatic resources, processing bison and repairing or replacing worn items in their toolkits. Cultural level five contains far fewer lithic tools with only one projectile point, two biface blanks, and four unifaces but, it contains a more extensive faunal sample which exhibits increased utilization of pronghorn. The faunal material still shows an emphasis on bison at 65% of the identified specimens but pronghorn makes up 21% with the remaining 14% being comprised of wapiti, deer, birds, and gastropods (Greiser *et al.* 1985:861). Dates for this level appear to cluster around 5025 calendar years before present. Cultural level six is of interest for its considerable antiquity (5830 BP), and the fact that pronghorn comprise over 78% of the identified faunal specimens while bison represent only 3.3%. Other fauna include wolf, jackrabbit, deer, rodents, and birds (Greiser *et al.* 1985: 867). Level six contained seven Oxbow projectile points, five biface fragments, and four unifaces. A list of all of the radiocarbon dates from Sun River and other sites mentioned in this text can be found in Appendix A. Because of the long temporal span of the occupations at the Sun River site, Greiser *et al.* (1985: 870-874) were able to make several statements about Oxbow complex responses to environmental change. Palynological studies on samples taken from various levels at the site reveal that the environment during the occupations of levels five and six was drier than the level four occupation, although the driest period of the Altithermal was clearly over. Once again, all of the Oxbow levels from the Sun River site indicate that, in spite of an emphasis on bison procurement, the actual number of individual animals represented within each level strongly suggests that Oxbow complex people relied on hunting practices that had minimal impact on the bison population from any single event within a given area. The range of species exploited during each occupation serves to demonstrate the regional variability shown by Oxbow people while remaining within the confines of Oxbow adaptive strategies.

As has been exemplified by the sites discussed above, most Oxbow sites can be classified under a broad category of campsites. Within Saskatchewan, these are primarily located near existing streams, rivers, old meander scars and small oxbow lakes. Apart from campsites, Oxbow complex sites include individual and multiple burials and other sites of spiritual significance, including medicine wheels. At the Gray burial site (EcNx-1a) in southwestern Saskatchewan, the remains of 304 individuals were recovered from 99 burial units (Millar 1981a:104). Unfortunately their is a considerable amount of confusion about what is represented at the site and, although it has been reported as being almost exclusively an Oxbow complex repository (Millar 1981a), radiocarbon dates and artifact types suggest that several, possibly related, complexes used the site. Dates for the site are reported here in Appendix A. The dates range from SFU-297: cal 7281 [6523] 5764 BP to S-1450: cal 4144 [3830] 3476 BP. Morlan (1993:19) has interpreted the dates as possibly signifying a main early period of use by Oxbow complex people followed by a later period when the site was used by McKean complex people. The position followed in this thesis is that the Gray site assemblage exhibits continuity over a long period of time, virtually from late Mummy Cave series complexes through the Oxbow complex with a few isolated burials which date to later periods. The question of when a Mummy Cave series complex or complexes evolved into an Oxbow format is literally a 'gray' area (pun intended). The term 'format' is used here to describe the functional similarities in toolkits throughout the late Mummy Cave series complexes and the Oxbow complex, recognizing that subtle stylistic changes occurred over time. Although it is true that the Gray site assemblage contains very few diagnostic artifacts, perhaps copious radiocarbon dates and inferred relationships to other sites within the region based on less tangible characteristics like the use of red ochre, the presence of Old Copper artifacts, canid burials and the utilization of freshwater clams will help clarify the Mummy Cave~Oxbow transition period. It should be noted that the complete Gray site assemblage has been repatriated and reburied, but research on the material continues (E.G. Walker pers. com. 1998). Other burials that date to the same period as the Gray site include the Greenwater Lake site (Walker 1981) and the St. Brieux site (Walker 1984) both of which involved primary extended interments and red ochre. The Greenwater Lake burial was radiocarbon dated to S-1447: cal 5569 [5255, 5180, 5132, 5110, 5068] 4838 BP and included one large basally concave side-notched projectile point, while the St. Brieux burial was dated to S-520: cal 6165 [5899] 55651 BP but contained no diagnostic grave goods.

Wright (1995:321-327) notes that medicine wheels, which are primarily situated in the grasslands of Alberta, Saskatchewan, and Montana with a few others situated in Wyoming and South Dakota, appear to have their origins in the Oxbow complex based on research conducted by Brumley (1988) and Calder (1977). Calder (1977: 201-209) further speculates that much of the theology and ritual exhibited by Plains groups at contact had its origins at least as far back as the Oxbow complex. At the Majorville Cairn and Medicine Wheel site (Calder 1977), located in southern Alberta, excavation of a portion of the central cairn indicated continuous use and accretion of the feature since the Oxbow complex based on projectile points and radiocarbon dates obtained on bone samples recovered during the research. The purpose of the wheels is presently unknown although interpretations have included their use as astronomical devices, memorials, vision quests and symbolic Sun Dance lodges (Wright 1995: 321-322). It should be noted that all of these functional aspects are speculative and that any connection regarding such functions to the Oxbow complex is tenuous at best. If, during the Oxbow complex, people were organized into small bands throughout most of the year, then such features may have been important in relaying a sense of commonalty during those periods.

8.4 Oxbow, Old Copper and Trade

Of considerable interest, is the implied association of a copper crescent with Oxbow projectile points at Castor Creek (Wormington and Forbis 1965: 113-116). The items are tenuously associated based on postulated similarities in age, although the crescent was recovered completely out of context in the creek bed while the projectile points were excavated from a palaeosol some distance from the find spot. The Oxbow level of the excavation has been radiocarbon dated to approximately 4475 +/- 1000 rcybp (Forbis 1970: 17) and the copper crescent is similar to Wittry's Type II B knife (Wittry 1951 as adapted by J. Steinbring 1970) characteristic of the Old Copper industry of the Great Lakes area dating from between 5000 and 3000 BP (Gibbon 1998: 27). The Oxbow association with Old Copper cultural material extends beyond this find. At least two examples of native copper projectile points diagnostic of the Old Copper industry have been recovered from within Saskatchewan, one of which was recovered from a site which also contained an Oxbow projectile point (Meyer 1979, 1981a). The McCallum site is situated along Snake Rapids in northern Saskatchewan (Meyer 1979: 8) and contains a mixed assemblage of Middle and Late Precontact Period artifacts including an Oxbow point, Clearwater Lake Phase pottery, various endscrapers, and a native copper projectile point assignable to Wittry's Type I F (1951 as adapted by Steinbring 1970). Trace element analysis revealed that the copper point had levels of silver characteristic of Lake Superior copper (Meyer 1981a: 123). Meyer stops short of claiming that the Oxbow point and the Old Copper point are associated; however, the temporal spans for both of these artifact types may overlap. A second Old Copper projectile point was recovered as an isolated find near the Torch River, in northern Saskatchewan (Dyck 1980). The point is very similar to that described by Meyer (1979, 1981a) and is classified as Wittry's Type I F (Wittry 1951 as adapted by Steinbring 1970). Gibbon (1998) has recently suggested that the Old Copper industry in Minnesota may be linked with Oxbow points recovered in that state. The main problem is that the Old Copper industry is very poorly dated, in part, because the soils of the forested areas in which these artifacts are often recovered are not conducive to good bone preservation. Furthermore, soils in these areas are notoriously thin and stratigraphic separation of artifact bearing levels may simply not exist. The strongest evidence of an Oxbow~Old Copper association comes from the Gray Burial site in southwestern Saskatchewan where copper artifacts, including tube beads, were placed as grave goods with human interments (Millar et *al*. 1972, Millar 1978, 1981a). Burial unit 88 contained the remains of one adult and one child associated with heavy ochre staining, bone beads and a single rolled copper tube bead (Morlan 1993: 18). The burial unit was radiocarbon dated to RIDDL-515: cal 5578 [4989] 4529 BP (Morlan 1993: 18-19), while another copper fragment was associated with burial unit 58, radiocarbon dated to GX-3373: cal 5731 [5199, 5045] 4408 BP. Although neither of these burial units is directly associated with Oxbow projectile points, three units containing Oxbow points were radiocarbon dated to approximately the same age (Morlan 1993: 18-19). A third piece of native copper was recovered from burial unit 42 radiocarbon dated to S-646: cal 4790 [4342,4335, 4287] 3929 BP. The existence of native copper items in Oxbow assemblages indicates that Oxbow people must have maintained some strong ties to the east where the native copper sources exist. Steinbring (1980: 52-66) discusses the relationship of Old Copper artifacts to possible Oxbow materials from Manitoba where Oxbow projectile points were associated with Old Copper artifacts at the Jansson site located along the Winnipeg River (Steinbring 1980: 55-56). He (1980: 55) felt that the site could not be older than 4500 years based on the copper point type. This date is in perfect accord with the Oxbow complex on the grasslands. Steinbring (1980: 65) suggested that Old Copper items entered the Winnipeg River drainage out of the east beginning at about 5000 BP. This is, of course, synchronous with the establishment of the early stages of the Oxbow complex recognized at the Gray site (Millar 1981a) and elsewhere. Conversely, Buchner (1979: 81) stresses emphatically that Old Copper tools were not associated with Oxbow materials at LM-8 within the Caribou Lake Study area of southeastern Manitoba, but, instead, with a post-Oxbow Raddatz component .

The eastern influence on the Oxbow and Mummy Cave series complexes should not be overlooked. Numerous examples of this eastern influence exist including the presence of Old Copper industry items and shell beads from the Atlantic coast in association with Oxbow materials at the Gray site (Millar 1978: 332). Sites such as the Gray site (Millar 1978) represent a union of influences which are difficult to interpret. The designation of one specific locality as an ossuary has antecedents to the southeast (Charles and Buikstra 1983) where such sites usually contain far fewer individuals than the Gray site. Similarly, the exploitation of freshwater clams, both as a food source and as a source of raw materials for the production of paint dishes, gorgets, and other body adornments may be derived from either earlier or contemporary complexes in the American Midwest where numerous species of freshwater clams were heavily exploited for various reasons (see Styles *et al.* 1983, Charles and Buikstra 1983). It seems reasonable to assume that trading networks had been established among peoples of various complexes dating back to the Paleoindian Period and that a tremendous web of networks was influential throughout the entire Precontact Period. In short, no single complex is an entirely distinctive phenomenon because of subtle variations in assemblages in response to any number of circumstances including environment, and 'external' influences such as long distance trade. The term external is, perhaps, inappropriate as trade is surely an integral element of any complex.

8.5 Oxbow Domestic Dogs

Right from the initial discoveries and descriptions of Oxbow materials, it was clear that Oxbow people had a strong and close association with domestic dogs. In describing the canid remains from the Oxbow Dam site, Nero and McCorquodale (1958: 88-89) note that the distinction between a medium-sized wolf and a domestic dog derived from wolf stock is virtually impossible to make using the postcranial remains that were recovered and so, they refer to the remains as medium sized "wolf (?)." Later, however, at Long Creek, McCorquodale (1960: 88) confidently assigns canid humerii and other postcranial elements to *Canis familiaris* based on osteometric analysis. Other sites including Harder (Dyck 1977: 47, Morlan

1994a: 761-763), Gray (Millar *et al.* 1972: 20, Millar 1981a: 112, Savage 1974) and DhMn-1 (this volume), all include positively identified domestic dog remains. The dog remains are from a variety of contexts ranging from ritual burials of draft animals associated with ochre and human interments at the Gray site (Millar 1981a: 112; 1978: 363-369, Savage 1974), to burned and butchered remains at DhMn-1 where canids were occasionally used as food. At many Oxbow sites, canid remains are second only to bison in frequency. Certainly, not all of the identified canid remains are those of domestic dogs. Coyotes (*Canis latrans*), wolves (*Canis lupus*) and foxes (*Vulpes sp.*) are also commonly encountered.

8.6 Oxbow Bison Hunting Strategies

Much has been made of the fact that, although bison is by far the most common species represented in Oxbow assemblages, no Oxbow bison kill sites have been reported to date (Millar 1981b: 84; Dyck 1977:10, 1983: 96; Amundson 1986:28; Morlan 1994a: 758; Wright 1995: 310). Dyck (1983:96) notes that this may be the result of two possibilities, namely, sampling error or an indication that Oxbow people used alternative hunting strategies to mass kills to obtain bison meat. The latter appears to be the case at the Harder site (Morlan 1994a) where bison elements identified to gender and age indicated that multiple small-scale kill events were likely responsible for the assemblage based on information combining bison herd composition and seasonality. Morlan's (1994a) re-examination of the faunal remains from Harder confirmed Dyck's (1977) interpretation that the site was a winter occupation, but Morlan noted that a single herd comprised of mature male, female and juvenile bison would be unlikely during the winter months. Dyck (1977:55-56) had originally speculated that some form of communal hunt may have been used which involved a surround or trap in the rolling terrain. Morlan's (1994a) results correlate well with Dyck's (1977) estimates for human campsite populations during Oxbow times. Dyck (1977: 55-57) used ethnographic information (Palliser 1968: 251-252) on the number of occupants usually associated with single dwellings to estimate the population of the Harder site at between 42 and 56 individuals.

It is possible that an adaptive strategy which excluded the use of large-scale bison kills was instrumental in the success of the Oxbow peoples. Selective hunting may have served to maintain significant bison populations even during periods of stress. This need not mean 'selective hunting' in the sense of 'culling a herd' where only sick or injured animals are eliminated as surely this would leave a detectable presence in the archaeological record. However, the success of the complex in the grasslands and parklands is inextricably linked to a solid understanding of bison population dynamics by the Oxbow people, something that must have been extremely important for survival during the preceding Altithermal period out of which the complex appears to have emerged. Studies of palaeoclimatic conditions indicate that the extreme aridity associated with the Altithermal was in the process of subsiding, just as Oxbow complex peoples were beginning to flourish. Certainly, Amerindian populations were familiar with population control as is reflected in their use and manipulation of domestic dogs. Just as certainly, groups that were strongly tied to the bison food resource must have understood something about how long it took for herds to regenerate following kill episodes. Such groups may have chosen a strategy which consisted of a series of minimal impacts to bison herds, involving isolated kills or small groups kills. Morlan (1994a) has proposed that wolf crania and paw elements recovered from the Harder site may represent the remains of wolf skins worn as disguises by hunters stalking bison. This form of adaptive strategy may have occasionally produced short-term bison meat deficits but was beneficial to bison and human populations over the long-term. The occasional use of other animals as sources of fats and proteins is inherent in this system although there is no reason to view non-bison faunal remains as starvation foods. The presence of non-bison remains are no more likely an indication of a scarcity of bison than they are an indication of a relative abundance of other foods. The presumption that protein sources other than bison were starvation foods is likely related to archaeological reliance on ethnographic literature. Understandably, archaeologists frequently use ethnographic analogies to interpret archaeological assemblages without considering that immense differences may exist between the known ethnographic culture and the unknown archaeological complex. In some cases, it may simply be that ethnographic analogies are inappropriate for describing past human behavior. For example, ethnographic accounts indicate that Protohistoric and Historic Plains Period groups had adopted subsistence strategies that were reliant on mass-kills although other methods were also known and practiced (Verbicky-Todd 1984). These groups, no doubt, felt the impact of the extirpation of the bison very hard and, therefore, foods other than bison may have been relayed as starvation foods to ethnographers and fur traders but, there is little evidence to suggest that this was the case during Oxbow times when other hunting strategies appear to have been paramount. Instead, human populations that were in a homeostatic relationship with bison populations may have been in a position to exploit other animal resources at will. Even intensified utilization of bison resources including bone marrow and grease extraction need not be viewed as indications of resource stress but, instead, may be a reflection of some form of preventative measure to ensure resource conservation. In this case, adaptive strategies that were developed out of necessity by Mummy Cave series complexes were simply carried over into the Oxbow complex.

8.7 Origins of the Oxbow Complex

As discussed above, Reeves (1973: 1245) noted that similarities existed between early Oxbow assemblages and peceding Mummy Cave assemblages and concluded that an evolutionary relationship existed. Similarly, Walker (1992: 144) has recently proposed that the origins of the Oxbow complex were within the Saskatchewan Basin, probably an *in situ* development out of an Altithermal-aged Mummy Cave series complex like Gowen. If this is the case, as is currently accepted (Reeves 1973; Walker 1992; Forbis 1992; Dyck 1983; Wright 1995), then some type of cultural continuity should exist which is reflected, not only in aspects of toolkit configuration but also in adaptive strategies. This is precisely the relationship between the Gowen site assemblages (Walker 1992) and Oxbow components in the grasslands and parklands. Comparison between Oxbow assemblages and grassland Mummy Cave series assemblages is difficult because the sample size for the latter is small. However, some obvious parallels do exist. Oxbow components do not show evidence of large-scale bison kills because these types of activities were not necessary for success. Instead, small groups of people practiced hunting techniques which were the same as their predecessors or possibly their ancestorss such as the Gowen people. Walker

(1992: 128-129) states that one common denominator for most Early Middle Period sites is the sparse nature of the assemblages, thought to be indicative of small, short term occupations by groups who hunted lone animals or small herds and maximized their nutritive returns with intensive processing activities. The increased artifact density associated with the Oxbow complex may be indicative of longer occupation or more regularly scheduled reoccupation of established habitation sites but the evidence does indicate that Oxbow people utilized the same subsistence strategy. The difference in frequency between Mummy Cave series components and Oxbow components on the Northern Plains is not a reflection of different adaptation but rather more favourable environmental conditions. Wright (1995: 310) characterizes the overall adaptive system of the Oxbow complex as "opportunistic and flexible" and notes that there is a broad range of subsistence strategies followed by Oxbow peoples indicated by regional variation. Furthermore, he suggests that this type of flexibility is evident in Oxbow occupation of the boreal forest and peripheral plains areas. If Oxbow people were opportunistic and flexible, then Mummy Cave series people certainly had to have been as well. The fact that Mummy Cave series peoples were successfully adapted to an Altithermal Plains environment by practicing selective hunting, is alone, enough to explain the success of the Oxbow complex using a similar hunting strategy and substantially improved environmental conditions.

Viewed in their entirety, the chipped tool assemblages of the Gowen sites (Walker 1992) are technologically very similar to Oxbow assemblages, including the heavy use of split-pebble technology in the earlier material. Dyck (1970, 1977) notes the use of split-pebble endscrapers in Oxbow assemblages from the Harder and Moon Lake sites near Saskatoon. The functional aspects of the tools in Gowen and Oxbow assemblages appear to be very similar and many forms, such as large hafted bifaces, ovoid bifaces and flake perforators, are identical. The heavy use of split-pebble technology at the Gowen sites may be an expression of local lithic resource utilization, a phenomenon often associated with the Oxbow complex (Wright 1995: 315). Furthermore, Low (1997: 216-246) reports that Gowen, Oxbow, McKean and Besant projectile points made using split pebble technology exist in various collections throughout the province. Low (1997: 245) suggests that, based on the artifacts included in his study, bipolar split pebble technology progressed from east-central Saskatchewan to western Saskatchewan during the Early Middle Precontact Period (Mummy Cave series) and the Middle Middle Precontact Period (Oxbow). Inherent in this progression is the continuity of this technology from the Gowen complex to the Oxbow complex.

A correlation between reasonably early radiocarbon dates and what appears to be a central core of Oxbow complex sites in and around the Saskatchewan Basin, strongly suggests an *in situ* development for the complex out of a pre-existing local complex. Certainly, traits for which there are antecedent variations in the Northern Plains appear to make up the bulk of material in assemblages from Oxbow components. At the center of these are the physical remains of the primary adaptive strategy found in the majority of all Oxbow components studied thus far, namely, a heavy reliance on bison using hunting strategies that involve only small-scale kills in which, perhaps, one or two animals are taken at a time. As discussed above, this technique is evidenced at the Gowen sites (Walker 1992) which date to approximately 6800 calendar years ago. Similarly, the utilization of canids, including domestic dogs, as food is a tradition which extends far back in Plains prehistory. Evidence from the Horner site in northwestern Wyoming indicates the use of domestic dogs back to the Palaeoindian Period (Walker 1987: 334).

8.8 Oxbow Settlement Patterns

In attempting to explain the presence of Oxbow complex materials in the boreal forest, Buchner (1981) suggested the movements of the Oxbow people were synchronous with the movements of bison. Buchner also suggested that, as temperatures fluctuated and seasons became less predictable at the end of the Altithermal (Atlantic) and into the Medithermal (sub-Boreal) climatic episodes, bison seasonal migrations were sufficiently disrupted to affect the timing of bison herd movements out of the grasslands and into the parkland wintering grounds. The supposition was that human populations moved ahead of bison populations, reaching the wintering grounds first. If the predicted time of arrival for the bison was incorrect or if climatic conditions were such that bison did not enter the parkland region at all, then human groups may have been forced farther into the shelter of the forest in search of large game animals, eventually developing new subsistence strategies focused on exploiting the boreal forest ecosystem. Buchner (1981) referred to this theory as the 'Anomalous Winter Hypothesis.' Dyck (1983:100) offers another explanation. In his opinion, it may have been that climatic conditions were such that the boreal forest margins were further north and east at the time of the Oxbow occupations and that the areas were grassland or parkland during that period. A third explanation may be that the Oxbow people, with a propensity to establish networks along drainage systems, had the skills to successfully adapt to the wide variety of ecozones within a larger resource base. If any 'push' or 'pull' was required to move Oxbow people into the boreal forest it may also have been an evolutionary trend toward regional variability that was influenced by interaction with more distant groups.

Spurling and Ball (1981) attempted to sort out this problem using a statistical approach. Their results are interesting, but inconclusive, because of a lack of standardized criteria for assessing Oxbow assemblages and the huge discrepancy in research approaches used during the data gathering stage. In other words, a thoroughly researched and excavated component will yield different results than a surface collected site even though in reality, the site represented by a surface collection may be extremely similar to its excavated counterpart. The objectivity of their statistical approach was admittedly undermined by subjective decisions made on incomplete data (Spurling and Ball 1981: 92). The authors acknowledged the fact that many subjective and sometimes speculative decisions had to made regarding various site assemblages because occasionally information that was required for their study was not always well documented (Spurling and Ball 1981: 92). Their research suggested that Oxbow complex sites located in the grasslands with extensive tool assemblages appeared to be "residential base" sites while assemblages associated with lake shore or stream-side locations that were boreal forest or transitional forest zones during the occupation were generally consistent with "field camps" according to research by Binford (1980). A second aspect of their study dealt with the timing of movements into the boreal forest and ultimately with the origins of the Oxbow complex.

To accomplish this Spurling and Ball (1981) selected radiocarbon dated Oxbow components across the Northern Plains, including sites in the grasslands, parklands and boreal forest zones, then classified the sites into five categories according to age. Their results indicate the relative abundance of early Oxbow components in the grasslands of southern Alberta, Saskatchewan and Manitoba at the time of their publication but they also demonstrate that substantial early influences or, perhaps even origins, come from east and west of the main grassland concentration. This is not totally surprising because at the time of the publication little, if any, information was available on pre-Oxbow side-notched complexes on the northern grasslands. Since that time, assemblages from the Gowen sites (Walker 1992) have been thoroughly examined and cultural continuity into Oxbow has been proposed, thereby supporting Reeves' (1973) proposition that Oxbow developed from the Mummy Cave series complexes.

8.9 Overview of the DhMn-1 Oxbow Assemblage

The results of the analysis of the Oxbow assemblage recovered in 1995 and 1996 at DhMn-1 indicate that the site represents a relatively late example of an Oxbow campsite. This is, of course, contrary to the findings of the initial research conducted at the site in 1956 (Nero and McCorquodale 1958). The new data fit Reeves' criteria for "Classic" Oxbow material with no Mummy Cave series projectile points represented (Reeves 1973: 1245), rather than an early assemblage which includes such items. A new radiocarbon date on solubilized bone collagen from a left tibia of a bison, collected in association with five typical Oxbow projectile points, suggests that the site was occupied at S-3648: cal 4513 [4277] 3994 BP rather than the original reported age of S-44: cal 6289 [5947] 5655 BP (Morlan 1993). The areal extent of the site could not be adequately assessed because a major portion of the terrace east of the excavation block was not available for testing but, it is suspected that intact components exist beneath a gravel road which borders the east side of the site. The assemblage is very similar to other Oxbow complex materials from sites located in riverine environments. The lithic assemblage, primarily made from locally available lithic materials, repeats patterns found at other sites where broken, unserviceable discarded tools make up a high percentage of those recovered. An area containing several thousand pieces of chert debitage located toward the north end of the excavation block is interpreted as a flintknapper's workshop area. The types of tools recovered across the entire excavation block include ovoid blades or bifaces, hafted bifaces, perforators, unifacial knives, concave scrapers, sidescrapers, endscrapers and projectile points and are all commonly associated with Oxbow components elsewhere. Furthermore each of these tool types has a functional counterpart, which is often stylistically identical, in earlier Gowen assemblages. The presence of unifacial knives and scrapers indicates that some hide processing activities likely took place at the site during this occupation. Although no pit features or hearths were detected, the highly fragmented nature of excavated bison limb elements suggests that bone marrow and grease extraction were also carried out at this time. As with all known Oxbow assemblages, the small number of bison represented indicates that hunting strategies which targeted very few individuals at a single time were employed. It is proposed that this form of subsistence adaptation links the Oxbow complex with earlier Northern Plains Mummy Cave series complexes, such as Gowen. A relatively high percentage (33.3 %) of the total amount of bone was burned or charred. The faunal assemblage includes a very high percentage of canid remains accounting for nearly 8 % by weight of all of the identified species. In fact, the MNIs and NISPs for canids are higher than those of bison; however, when the overall size of the animals is considered, bison make up a much larger percentage of the diet. Measurements of lower carnassial teeth on two mandibles appear to indicate that, at least, one domestic dog was killed and butchered during the occupation. Of particular interest, is the presence of butchered Painted Turtle remains within the assemblage. These, in combination with freshwater clam remains found in numerous Oxbow components indicate that the complex was well adapted to riverine environments. As well, they serve to support theories of regional variability regarding Oxbow subsistence practices. It should be noted that the use of turtles and clams for subsistence purposes and as sources for raw materials for tools and decorative items is much more commonly encountered to the southeast. Seasonality at DhMn-1 could not be determined using bison remains but the presence of turtle strongly suggests that the site was occupied during the late spring to early fall when such species are active.

Re-analysis of the original Oxbow Dam assemblage suggests that a similar range of activities was carried out in the portion of the site excavated by museum staff in 1956 (Nero and McCorquodale 1958). The extremely low percentage of burned bone recovered by the museum may be a reflection of collection techniques used or conversely, it may indicate that the area of the site excavated in 1956 was used for some form of processing which did not require the bone to be heated or burned. In some respects, the re-analysis of the original museum material (Nero and McCorquodale 1958) and its subsequent reassignment as a relatively late Oxbow complex assemblage strengthens the association between Oxbow and the Mummy Cave series in that, prior to the re-analysis, many archaeologists had assigned it to the earlier period partly based on stylistic similarities thereby, implicitly, recognizing an evolutionary link.

CHAPTER NINE
SUMMARY AND CONCLUSIONS

9.1 Summary of Research

This thesis has involved the re-analysis of cultural material collected from the Oxbow Dam site (DhMn-1) by the Saskatchewan Museum of Natural History in 1956 (Nero and McCorquodale 1958). Part of the research included a continuation of excavations at the site in order to enlarge the sample and to obtain valuable contextual information regarding the museum collection. To accomplish this, an area of roughly 18 square meters was excavated as a single block in 1995 and 1996. Although the area excavated in 1956 has been completely eroded away during subsequent floods, museum photographs indicate that the new excavation block is located several meters south of the original and is higher up the embankment.

Recent excavations indicate that the site contains discrete multiple components separated by alluvial, aeolian and possibly colluvial deposits. Seven cultural levels have been described, although only three have been radiocarbon dated or assigned to cultural complexes based on diagnostic artifacts. Samples from the three uppermost cultural levels contain only minimal amounts of lithic debitage, fire-cracked rock and a varied assortment of faunal remains ranging from Pigmy Shrew (*Microsorex hoyi*) and snake (*Thamnophis sp.*) to canid and bison. The assemblage from cultural level one is far too small to make any conclusive remarks on activities carried out at the site during the occupation. Artifacts from levels two and three suggest that activities surrounding marrow and grease extraction as well as lithic tool production took place during these occupations. Unfortunately, none of these upper levels can be assigned to any cultural complex.

Cultural level four contains a fragment of a side-notched projectile point of indeterminate affiliation, as well as a finely made Knife River Flint endscraper and three sidescrapers. Lithic material used in this assemblage indicates that the occupants had connections with the Knife River Flint quarries in Dunn and Mercer Counties of North Dakota and also with the Antelope Chert quarry area in Mackenzie County, North Dakota. Once again, the faunal assemblage indicates a heavy reliance on bison although all of the elements recovered could represent one individual. The presence of bison long bone articular ends suggests that marrow extraction activities took place during this occupation but not grease extraction, as the proximal and distal ends of such elements are rich in grease. Other fauna represented fall into a category of microfauna including snake, ground squirrel, mouse and vole. It is not currently known whether or not any of the microfauna represent alternative sources of human food.

The cultural assemblage from level five contains one unifacial point preform, one endscraper, one biface fragment and one Hanna type projectile point base, indicating that this occupation likely occurred between 4200 and 3200 BP (Morlan 1993: 39). The faunal remains include bison, canid, woodchuck, mouse, vole, frog, and goose. While bison appear to have been the primary food source, it is likely that canid, woodchuck, goose and frog added some variety to the diet of the occupants. As in level four, processed bison long bone ends suggest that marrow extraction activities were taking place at the site during this occupation.

The artifacts recovered from cultural level six have been the primary focus of this thesis in conjunction with Oxbow assemblages from across the Northern Plains. As mentioned above, the university assemblage was excavated to supplement data gathered in 1956 and to try to resolve several questions regarding the museum excavated materials. The newly excavated material includes portions of five Oxbow projectile points, one unfinished preform, two hafted bifaces, one ovoid biface, numerous endscrapers and sidescrapers, one concave scraper and several fragments of assorted bifaces and unifaces. A large percentage of the artifacts are made from heat-treated Swan River Chert, indicating that Oxbow people were aware of the beneficial affects of thermal alteration on some lithic materials. Despite the presence of artifacts associated with long distance trade such as Old Copper artifacts and marine shells in Oxbow components within the Northern Plains area, evidence for trade involving lithic materials is scarce. Most components indicate that Oxbow people relied heavily on local lithic resources, particularly Swan River Chert. Faunal remains from this component, again, show a heavy reliance on bison but a substantial amount of canid remains is also present. Measurements on carnassial teeth suggest that, at least, one of the butchered canids is a domestic dog. Like all documented Oxbow assemblages, bison hunting strategies at DhMn-1 appear to have focused on selective approaches where very small numbers were taken at one time. All of the identified bison remains from this component may represent only three individuals. This appears to be a continuation of a hunting technique that was commonly used throughout the Altithermal as noted by Walker (1992). Other faunal material of interest include the butchered and burned remains of a Western Painted Turtle, burned snake, burned frog, burned pronghorn, various burned and unburned mice, voles and squirrels, and one unburned cottontail. While turtle remains are generally associated with groups to the east or southeast, evidence for turtle consumption by bison-hunting Plains groups dates back to the Palaeoindian Period in Wyoming where similar burned and butchered Painted Turtle (*Chrysemys picta*) remains were recovered at the Horner site, a Cody complex bison kill located along the Shoshone River (Walker 1987: 329). Seasonality at DhMn-1 could not be determined using bison elements, but it seems logical that the site was occupied during the late spring to early fall based on the presence of turtle, snake and frog. Taken in their entirety, the level six faunal remains support the notion that Oxbow groups were highly adaptable and opportunistic when it came to the food quest. Evidence from DhMn-1 and other Oxbow sites such as the Sun River site in Montana (Grieser *et al.* 1985) and the Amisk site near Saskatoon (Amundson 1986) demonstrate the regional variability that occurs in Oxbow assemblages while simultaneously demonstrating strong continuity within their lithic assemblages.

Cultural level seven contained bison limb elements with no visible signs of cultural modification as well as a fused shale projectile point preform which appears to have come from a disturbed portion of a unit. While it is difficult to determine whether or not the level is actually cultural, the limb elements represented are only those which are commonly associated with secondary processing activities and no portions of the axial skeleton were recovered suggesting that the limbs were selected and transported to the site by humans. Isotope analysis of the bison tibia submitted for radiocarbon dating indicated that the animal was eating a high percentage of xeric grasses. This is entirely consistent with palaeo-environmental reconstruction for the area during the Altithermal Period. If the level is cultural, it represents occupation of this area around the proposed beginning of the Altithermal. Interestingly, the fused shale preform is similar to those used for later side-notched points rather than stemmed or lanceolate late Palaeoindian projectile point types characteristic of the period. Another potentially much older level may be represented by a thin Regosol which appears to contain a small amount of cultural material situated well below any of the cultural levels that were adequately sampled.

The 1996 excavations resulted in a new radiocarbon assay for the Oxbow component at the site. The new date (S-3648: cal 5413 [4277] 3994 BP) is in conflict with the museum date (S-44: cal 6289 [5947] 5655 BP; Morlan 1993) but is typical of dates for the complex as reported from other sites. It is proposed that the original date, based on charcoal from a hearth feature, was contaminated with charcoal derived from an underlying level. This underlying stratum (cultural level seven) produced a radiocarbon date of S-3644: cal 7934 [7761] 7585 BP from solubilized bison bone collagen. The average age of sample S-3644 and S-3648 is 6019 BP, well within one standard deviation of the museum date. Further support for this proposition can be found in original museum field notes which illustrate that the dated hearth-pit feature was excavated into the lower level by the Oxbow people.

It is likely, therefore, that contamination of the museum sample was unavoidable.

9.2 Conclusions

The re-analysis of the museum assemblage was initially undertaken to study the origins of the Oxbow complex because the museum assemblage and corresponding radiocarbon date appeared to many archaeologists (Reeves 1973: 1245, Frison 1991: 86, Dyck 1983:92-95, Walker 1992: 194, Wright 1995: 300) to represent a transitional proto-Oxbow component demonstrating characteristics of the Oxbow complex and earlier Mummy Cave series complexes. While there can be little doubt that the original radiocarbon date was influential in the assignment of the site to a proto-Oxbow period, the lithics also showed characteristics that were atypical of the Oxbow complex as it was represented elsewhere. The re-analysis has demonstrated that the range of atypical artifacts can be attributed to component mixing at the location of the museum excavation. In other words, material from various complexes and components was assumed to be derived from a single component associated with the dated hearth-pit feature but recent testing and a reevaluation of the location of the museum test trench indicates that geomorphological processes had deformed the stratigraphy in the excavated area. Furthermore, artifacts found completely out of context were combined with excavated items ultimately creating a pseudo-transitional assemblage. Because this was the first *in situ* Oxbow component ever excavated, there simply was no comparative data against which to judge the collection. However, the fact that it was regarded by so many archaeologists as a very early Oxbow component with strong affinities toward Mummy Cave assemblages elsewhere, is viewed as support for the notion that Oxbow developed out of Mummy Cave regardless of the age of the DhMn-1 assemblage. The new data indicate that the site is likely a relatively late expression of the Oxbow complex but continuity does exist with Mummy Cave assemblages. As mentioned above, small-scale bison procurement strategies, as opposed to large-scale communal hunts, were the norm throughout the region during the Mummy Cave period and the subsequent Oxbow period. Methods of bone processing for the extraction of marrow and grease that first appear during the Altithermal continue into Oxbow times. Similarly, lithic toolkits are identical between northern grasslands complexes during the two periods or they have counterparts which may vary somewhat in form but serve the same function. The presence of Oxbow or Oxbow-like projectile points in assemblages dating close to 7000 BP at the Gowen sites near Saskatoon has been used to link these two complexes (Walker 1992). Moreover, both Oxbow and Gowen assemblages have very similar toolkits which include large hafted bifaces and crude ovoid 'backed' bifaces as well as various straight, concave and convex unifaces.

While the general adaptive subsistence strategy is largely derived from *in situ* antecedent complexes, many trade items have eastern origins. The trade networks used during Oxbow times were probably an outgrowth of their extensive use of riverine environments. Enhanced trade during the Middle Middle Precontact Period is reflected by the presence of copper and marine shell artifacts recovered as grave goods at the Gray burial site in southwestern Saskatchewan. Riverine environments were of prime importance to many complexes because of their increased biological diversity, their use as trade and travel routes and their use as water sources. Sand hill habitation sites, however, indicate that diverse biomes were utilized by Oxbow people, again perhaps, an indication of predisposed adaptation toward the arid conditions of the Altithermal. Furthermore, while many Oxbow sites are located in boreal forest areas which may have been parkland or grassland regions at the time of occupation, certain sites such as the McCallum site (Meyer 1981a) may represent derivatives of the grassland complex with subsistence adaptation oriented toward boreal forest resources, however, this relationship is currently poorly understood. It seems likely that regional variability could also be linked to interaction with neighbouring populations adapted to different resource bases. This regional variability is reflected in the faunal assemblages from many Oxbow components while toolkit assemblages are extremely uniform.

In conclusion, no archaeological complex can be viewed in complete isolation. In attempting to conjoin the Oxbow complex with possible antecedent complexes in the northern grasslands, it is evident that strong similarities exist in subsistence and technological adaptations between grassland Mummy Cave series assemblages, like Gowen, and Oxbow assemblages. The 1956 assemblage from DhMn-1 likely does not represent this specific 'transitional' period as was once suspected, instead, it is clear that the transition from grassland Mummy Cave series complexes to the Oxbow complex is a smooth continuum evident in virtually every Oxbow assemblage. The relative abundance of Oxbow components is likely due to improved environmental conditions rather than to major shifts in technological adaptation or differential resource utilization. Oxbow, then, can be viewed as a highly efficient plains-adapted complex with a proven capability to exploit a wide variety of ecosystems using hunting strategies developed in the grasslands during the Early Middle Precontact Period. What appears as an explosion of the complex onto the Northern Plains is likely a reflection of improved environmental conditions which increased small-scale hunting and foraging opportunities.

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APPENDIX A

A COMPILATION OF RADIOCARBON DATES FROM OXBOW COMPLEX COMPONENTS ON THE NORTHERN PLAINS

Table A. 1: Table of calibrated and uncalibrated radiocarbon dates for selected Oxbow complex components on the Northern Plains.

The following list includes radiocarbon dates reported in various sources. Both uncalibrated and calibrated versions of the dates appear. For some of the dates, the material type was not reported nor was any information available regarding the normalization of dates on bone due to isotopic fractionation. Morlan (1998 pers. com.) suggests that an average C13 ratio of -17.2 ± 1.0 ‰ should be applied to Oxbow-vintage bone samples before calibration where no such information was collected or reported. This average is based on data collected from 50 human skeletons from the Gray site (Lovell *et al.* 1986) where C13 ratio averaged -17.5 ± 0.3 ‰ and C13 ratios from samples from the Harder site (Morlan 1994a) and the Oxbow Dam site (this volume). Morlan further suggests that the difference in trophic levels between bison and humans due to fractionation, while detectable, amounts to only about 1.0 ‰ and is, therefore, negligible for the current purposes. The average of -17.2 is equivalent to an additional 125 ± 16 years (Morlan pers. com 1998). The list should be used with discretion but it gives a rough idea of the temporal range for the Oxbow complex. All calibrated dates are reported at two sigma. The following abbreviations apply to the chart:

rcybp:	radiocarbon years before present (1950)
BP:	before present
cal:	calibrated
BCOS	Bone collagen (solubilized)
BCOI	Bone collagen (insoluble)
N/A	Not Applicable

*Where the word BONE appears in the material dated column, it indicates that the source did not specify whether the collagen was solubilized or insoluble.

Site Name	Lab No.	Source	Material Dated	Uncalibrated Age (rcybp)	C13 Ratio (Negative Values)	Normalized Age (rcybp)	Calibrated Age@2 Sigma (Calendrical Years BP)	Calibrated Source
Oxbow Dam (DhMn-1)	S-44	Nero and McCorquodale 1958	Charcoal	5100+/- 210	N/A	N/A		
Oxbow Dam (DhMn-1)	S-44	Nero and McCorquodale 1958	Charcoal	5350+/- 250	N/A	N/A		
Oxbow Dam (DhMn-1)	S-44	Nero and McCorquodale 1958	Charcoal	5200+/- 130	N/A	N/A	S-44:cal 6289 [5947] 5655	Morlan 1993
Oxbow Dam (DhMn-1)	S-3648	This Volume	BCOS	3760+/- 80	18.05	3870+/- 80	S-3648:cal 4513 [4277] 3994	Pearson and Stuiver 1993
Oxbow Dam (DhMn-1)	S-3644	This Volume	BCOS	6810+/- 90* Component below Oxbow	14	6985+/-90	S-3644:cal 7934 [7761] 7585 * Component below Oxbow	Linick et al. 1986, Pearson et al. 1993
Long Creek DgMr-1 Level 7	S-50	McCallum and Wittenberg 1962	Charcoal	4620+/-150	N/A	N/A	S-50:cal 5720 [5317] 4869	Morlan 1993
Long Creek DgMr-1 Level 8	S-52	McCallum and Wittenberg 1962	Charcoal	4620+/-80	N/A	N/A	S-52: cal 5572 [5317] 5049	Morlan 1993
Long Creek DgMr-1 Level 8	S-53	McCallum and Wittenberg 1962	Charcoal	4650+/-150	N/A	N/A	S-53: cal 5726 [5324] 4873	Morlan 1993
Gray EcNx-1	S-1450	Morlan 1993	BCOS	3415+/-105	17.2	3540+/-121	S-1450: cal 4144 [3830] 3476	Pearson and Stuiver 1993
Gray EcNx-1	S-706	Morlan 1993	BCOI	3485+/-195	17.2	3610+/-211	S-706: cal 4514 [3893] 3384	Pearson and Stuiver 1993
Gray EcNx-1	S-693	Morlan 1993	BCOI	3550+/-295	17.2	3675+/-311	S-693: cal 4854 [3982] 3258	Pearson and Stuiver 1993

Gray EcNx-1	S-707	Morlan 1993	BCOI	3750 +/- 180	17.2	3875+/-196	S-707: cal 4837 [4339, 4338, 4282] 3713	Pearson and Stuiver 1993
Gray EcNx-1	S-646	Morlan 1993	BCOI	3755+/-100	17.2	3880+/-116	S-646: cal 4790 [4342,4335,4287] 3929	Pearson and Stuiver 1993
Gray EcNx-1	GX-3373	Morlan 1993	BONE	4340+/-250	17.2	4465+/-266	GX-3373: cal 5731[5199, 5045] 4408	Stuiver and Pearson 1993
Gray EcNx-1	RDDL-515	Morlan 1993	BCOS	Not Reported	17.5	4420+/-190	RDDL-515:cal 5578 [4989] 4529	Morlan 1993
Gray EcNx-1	RDDL-512	Morlan 1993	BCOS	Not Reported	17.5	4510+/-140	RDDL-512:cal 5575 [5130] 4737	Morlan 1993
Gray EcNx-1	RDDL-514	Morlan 1993	BCOS	Not Reported	17.5	4600+/-130	RDDL-514: cal 5626 [5309] 4869	Morlan 1993
Gray EcNx-1	RDDL-513	Morlan 1993	BCOS	Not Reported	17.5	4600+/-170	RDDL-513: cal 5724 [5309] 4849	Morlan 1993
Gray EcNx-1	SFU-295	Morlan 1993	BCOS	4750+/-160	17.2	4875+/-176	SFU-295: cal 5982 [5601] 5078	Stuiver and Pearson 1993
Gray EcNx-1	S-619	Morlan 1993	BCOI	4955+/-165	17.2	5080+/-181	S-619: cal 6278 [5887, 58o7, 5767] 5337	Stuiver and Pearson 1993
Gray EcNx-1	S-647	Morlan 1993	BCOI	5100+/-390	17.2	5225+/-406	S-647: cal 6883 [5980, 5976, 5945] 4983	Stuiver and Pearson 1993
Gray EcNx-1	SFU-294	Morlan 1993	BCOS	5150+/-160	17.2	5275+/-176	SFU-294: cal 6411 [6160, 6158, 6025, 6011, 5993] 5649	Stuiver and Pearson 1993
Gray EcNx-1	S-1449	Morlan 1993	BCOS	2915+/-85	17.2	3040+/-101	S-1449: cal 3464 [3243, 3233, 3217] 2900	Pearson and Stuiver 1993
Gray EcNx-1	SFU-296	Morlan 1993	BCOS	5320+/-160	17.2	5445+/-176	SFU-296: cal 6635 [6278, 6220, 6218,] 5775	Stuiver and Pearson 1993
Gray EcNx-1	SFU-297	Morlan 1993	BCOS	5620+/-320	17.2	5745+/-336	SFU-297: cal 7281 [6523] 5764	Stuiver and Pearson 1993
Greenwater Lake FcMv-1	S-1447	Walker 1981	BCOS	4390+/-105	17.2	4515+/-121	S-1447: cal 5569 [5255, 5180, 5132, 5110, 5068] 4838	Stuiver and Pearson 1993
St. Brieux FdNf-2	S-520	Walker 1984	BCOI	4985+/-75	17.2	5110+/-91	S-520: cal 6165 [5899] 5651	Stuiver and Pearson 1993
East Pasture EcNx-4	S-637	Wilson 1972	BCOI	4235+/-55	17.2	4360+/-71	S-637: cal 5250 [4870] 4737	Stuiver and Pearson 1993

FcMv-1	S-1447	Walker 1981	BCOS	4309+/-105	17.2	4434+/-121	S-1447: cal 5448 [5028, 5013, 4990] 4657	Stuiver and Pearson 1993
FaNq-5	S-403	Dyck 1970	BCOI	4100+/-90	17.2	4225+/-106	S-403: cal 5033 [4827] 4444	Stuiver and Pearson 1993
Amisk FbNp-17	S-2536	Amundson 1986	BCOS	4015+/-195	17.2	4140+/-211	S-2536: cal 5294 [4805, 4767, 4639, 4637, 4614, 4581, 4578] 3997	Stuiver and Pearson 1993
Amisk FbNp-17	S-2535	Amundson 1986	BCOS	4120+/-190	17.2	4245+/-206	S-2535: cal 5443 [4832] 4231	Stuiver and Pearson 1993
Harder FbNs-1	S-490	Dyck 1977	BCOI	3360+/-120	17.2	3485+/-136	S-490: cal 4126 [3803, 3798, 3717] 3403	Pearson and Stuiver 1993
Harder FbNs-1	S-3453	Morlan 1993	BCOS	3420+/- 140	15.5	3570+/-140	S-3453: cal 4239 [3841] 3474	Pearson and Stuiver 1993
Harder FbNs-1	S-668	Dyck 1977	BCOI	3425+/-105	17.2	3550+/-121	S-668: cal 4148 [3833] 3479	Pearson and Stuiver 1993
Harder FbNs-1	S-3452	Morlan 1993	BCOS	4190+/-90	15.9	4335+/-90	S-3452: cal 5257 [4865] 4645	Stuiver and Pearson 1993
Harder FbNs-1	S-3444	Morlan 1993	BCOS	4410+/-150	18.3	4515+/-150	S-3444: cal 5585 [5255, 5180, 5132, 5110, 5068] 4736	Stuiver and Pearson 1993
FbNs-3	S-742	Dyck 1972	BCOI	3050+/-80	17.2	3175+/-96	S-742: cal 3624 [3376] 3156	Pearson and Stuiver 1993
Castor Creek FbOw-1	not reported	Forbis 1970	Charcoal	4475+/-1000	N/A	N/A	Sample number not reported: cal 7381 [5205, 5195, 5048] 2486	Stuiver and Pearson 1993
DlOp-2	RL-1585	Brumley and Rushworth 1982	BONE	4260+/-140	17.2	4385+/-156	RL-1585: cal 5453 [4967, 4939, 4876] 4533	Stuiver and Pearson 1993
Southridge EaOq-17	RL-1534	Brumley 1981	BONE	4165+/-150	17.2	4290+/-166	RL-1534: cal 5315 [4847] 4413	Stuiver and Pearson 1993
Southridge EaOq-17	RL-1535	Brumley 1981	BONE	4260+/-140	17.2	4385+/-156	RL-1535: cal 5453 [4967, 4939, 4876] 4533	Stuiver and Pearson 1993
Southridge EaOq-17	RL-1536	Brumley 1981	BONE	3670+/-130	17.2	3795+/-146	RL-1536: cal 4560 [4147] 3727	Pearson and Stuiver 1993
Majorville Cairn EdPc-1	S-856	Calder 1977	BONE	3845+/-160	17.2	3970+/-176	S-856: cal 4864 [4415] 3899	Pearson and Stuiver 1993

Hacault DkMl-1	BGS-1717	Nero pers. com.	BONE	3150+/-550	17.2	3275+/-566	BGS-1717: cal 4982 [3470] 2125	Pearson and Stuiver 1993
Hacault DkMl-1	BGS-1753	Nero 1997	BONE	2915+/-125	17.2	3040+/-141	BGS-1753: cal 3558 [3243, 3233, 3217] 2850	Pearson and Stuiver 1993
DjPo-47	RL-877	Driver 1978	BONE	4190+/- 150	17.2	4315+/-166	RL-877: cal 5440 [4861] 4419	Stuiver and Pearson 1993
FdPe-4	S-1884	Doll 1982	BONE	4790+/-475	17.2	4915+/-491	S-1884: cal 6732 [5646] 4408	Stuiver and Pearson 1993
DjPn-62	RL-433	Quigg 1975	BONE	1980+/-120	17.2	2105+/-136	RL-433: cal 2353 [2057] 1729	Stuiver and Pearson 1993
Sun River	Beta-5526	Greiser et al. 1985	Charcoal?	6750+/-440	N/A	N/A	Beta-5526: cal 8401 [7547] 6720	Linick et al. 1986, Pearson et al. 1993
Sun River	Beta-5533	Greiser et al. 1985	Charcoal?	5960+/-210	N/A	N/A	Beta-5533: cal 7239 [6840, 6837, 6786] 6307	Linick et al. 1986, Pearson et al. 1993
Sun River	UGa-4632	Greiser et al. 1985	Charcoal?	5660+/-470	N/A	N/A	UGa-4632: cal 7470 [6417] 5337	Linick et al. 1986, Pearson et al. 1993
Sun River	Beta-5527	Greiser et al. 1985	Charcoal?	5670+/-190	N/A	N/A	Beta5527:cal 6888 [6445] 5998	Linick et al. 1986, Pearson et al. 1993
Sun River	Beta-5517	Greiser et al. 1985	Charcoal?	5310+/-110	N/A	N/A	Beta-5517: cal 6305 [6167, 6147, 6095, 6065, 6041] 5773	Linick et al. 1986, Pearson et al. 1993
Sun River	Beta-5519	Greiser et al. 1985	Charcoal?	5040+/-100	N/A	N/A	Beta-5519: cal 5986 [5847, 5834, 5749] 5591	Stuiver and Pearson 1993
Sun River	Beta-5520	Greiser et al. 1985	Charcoal?	4640+/-120	N/A	N/A	Beta-5520: cal 5607 [5319] 4880	Stuiver and Pearson 1993
Sun River	Beta-5523	Greiser et al. 1985	Charcoal?	4560+/-70	N/A	N/A	Beta-5523: cal 5454 [5292] 4985	Stuiver and Pearson 1993
Sun River	Beta-5531	Greiser et al. 1985	Charcoal?	4390+/-110	N/A	N/A	Beta-5531: cal 5311 [4971, 4934, 4877] 4649	Stuiver and Pearson 1993
Sun River	Beta-5518	Greiser et al. 1985	Charcoal?	4370+/-110	N/A	N/A	Beta-5518: cal 5304 [4873] 4619	Stuiver and Pearson 1993
Sun River	Beta-5536	Greiser et al. 1985	Charcoal?	3450+/-350	N/A	N/A	Beta-5536: 4809 [3691] 2819	Pearson and Stuiver 1993
Whitemouth Falls	GAK-4248	Buchner 1979	BONE	4860+/-150	17.2	4985+/-166	GAK-4248: cal 6170 [5724] 5323	Stuiver and Pearson 1993
Whitemouth Falls	GX-4416	Buchner 1979	BONE	4625+/-150	17.2	4750+/-166	GX-4416: cal 5889 [5565, 5540, 5474] 4985	Stuiver and Pearson 1993
Farrell Creek	WSU-1952	Spurling 1980	not reported	2485 +/-130	N/A	Not Reported	WSU-1952: cal 2846 [2706, 2632, 2492] 2159	Pearson and Stuiver 1993

APPENDIX B

FIELD NOTES OF LT. INGLIS FROM HIS INITIAL VISITS TO THE OXBOW DAM SITE IN 1956

Figure B.1: Lt. Inglis' research questions for the material for that he found eroding out of the bank at DhMn-1. Courtesy of the Royal Saskatchewan Museum.

OXBOW

QUESTIONS

1. FLINT SCRAP OF AMBER COLOUR FOUND IN SMALL FLAKES ONLY — MUST HAVE BEEN VALUABLE MATERIAL?

2. NUT FRAGMENTS FOUND IN ASHES?

3. FLINT MATERIAL USED IS GENERALLY OF POOR MATERIAL – BETTER MATERIAL IS PRESENT IN TODAYS RIVER BED.

4. WHERE DID AMBER FLINT COME FROM?

5. COMPLETE BUFFALO SKELETON TO WEST OF FIRE (SHOULDER & RIB SECTION COMPLETE)

6. WATER COVERED CAMPSITE SHORTLY OR AT TIME OF ITS LAST USE.

7. SAND & GRAVEL WASH (MAY?) INDICATE FLOODING STAGE 3-4 FT ABOVE SITE AT A MUCH LATER DATE?

8. WHERE WAS WATER AT TIME SITE WAS IN USE?

SMALL QUANTITIES OF SHELL – SOME SIGN OF USE, ~~AND~~ FABRICATION BY HABITANTS